PAPER
TRADE JOURNAL
Title Reg. U. S. Pat. Off.

Vol. 115, No. 7 Thursday, August 13, 1942 Price Ten Cents

Diversion of Manpower From Mills Likely

Increasing Demand For Manpower and Electric Power For War Uses Apparently Will Affect Canadian Paper and Pulp Production —Plan For Meeting Situation Is Being Considered—Other News.

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., Aug. 10, 1942—Manpower and horsepower are the two greatest requirements in Canada at the moment. Both are needed in increasing number and amount for the ever-expanding war effort. These same two commodities are most likely to have a hampering influence on the pulp and paper industries during the coming months.

Manpower begins to assume the proportions of a major problem for some of the industries employing the greatest numbers of workers. The armed services are absorbing more and more men, and women, too, and the war industries are clamoring for more help all the time. About a quarter million more men will have been taken into the fighting units and munitions plants before the end of this year. This means that some of these men will have to be drawn from non-essential industries. More particularly, the largest employers of labor will have to get along with fewer workers. The pulp and paper industries during the last year for which figures are available, 1939, employed close to 40,000 men, in the mills and in the woods, beside another 100,000 workers who were employed part time. The automobile industry employed less than half that number. The flour and feed business ranks high in Canada, but the pulp and paper industries required six times as many employees that year. The baking industry ranks about seventh in Canadian industrial importance, but the pulp and paper industries required 50% more workers in 1939 than did the baking industry.

Paper and Pulp Industry May Lose Workers

It seems apparent that the pulp and paper industries will be called upon to divert some of its manpower to more essential war needs.

As men are switched from non-essential work to war work, electrical energy must also be switched. The amount of power diverted will depend upon a number of factors. The necessity of the work being performed will naturally be the greatest criterion in alloting both manpower and horsepower. Pulp and paper mills consume a relatively high proportion of electric power compared to the importance of the work to the war effort, but, on the other hand, these industries are a valuable source of United States exchange.

Therefore, consideration is being given to ways and means of supplying the United States' demand for pulp and paper and at the same time conserving power. In Ontario, this may be accomplished by diverting power from Ontario Paper Company and Beaver Wood Fibre Company in the Niagara peninsula, where the shortage of power is most acute. Alliance Paper, Interlake Tissue and Garden City Paper are also large operators in the Niagara district, producing book and specialty papers, and are also large users of electrical energy. It is not believed that these plants will be affected to any great extent. In the case of the Ontario Paper Company, controlled by the Chicago Tribune and New York Daily News, newsprint requirements could be taken care of by the mill at Baie Comeau, Que., in an area not likely to be affected by a power shortage.

Mills Now Operating at 65% Capacity

Usually, the pulp and paper mills are operated continuously, with double shifts, six days a week, when operating at capacity. In recent months the mills have been running at about 60-70% of capacity, those subject to prorating being the less active. It is not economically sound to operate on shorted hours and not in the national interest to employ men in the pulp and paper industries on a part time basis. More men must be found to further the war effort and as one of the larger employers of labor the pulp and paper industries can expect to be asked to make their contribution.

Where electric power is diverted from mills, there will also be some manpower available for war work, but the pulp and paper industries, like all other industries not classed as essential, will be asked to get along with as few workers as possible and employ more men unfit for the armed services or the more skilled trades.

Some concern has been felt regarding the labor supply for the woods operations next winter. Men were not too plentiful last winter and it is expected that the situation will be even worse this coming season. Happily, for the industry, settlers, who depend

(Continued on page 50)

Kimberly-Clark Acquires Large Building

Fireproof Structure of Marshall Paper Co. Is Leased and New Marshall Paper Corp. Has Been Formed — Paper Mill Employment Up In June — Arbitration Results In An Increase of Wages.

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., August 10, 1942 — Marshall Paper Company, leading wholesale jobbers of Appleton, has leased its large fireproof building to Kimberly-Clark Corporation, Neenah, Wis., and has disposed of its stock and business to new interests after functioning for 49 years.

No announcement has been made by Kimberly-Clark, but it is understood the lease covers a long term of years, and that the building will be used for storage of manufactured products of its mills in the Fox River Valley. The building has sidetrack facilities.

A new company has been formed to be known as Marshall Paper Corporation, with E. J. Schrage of Neenah, Wis., as president, Achilles Schloss as vice-president, and J. N. Schneider, secretary-treasurer. Mr. Schrage has been in the automobile business in Appleton and Neenah for a number of years, and will manage the new company. The business, covering a territory in Wisconsin, northern Michigan and other states, will be operated in the present building until November 1. Mr. Schloss and Mr. Schneider both have been with the Marshall Paper Company for a number of years, the latter as secretary. L. J. Marshall, president, and Harry M. Marshall, vice-president, will retire from the business, but their corporation retains ownership of the real estate. The latter and the late Samuel G. Marshall organized the firm about 49 years ago and built it to one of the largest in northern Wisconsin, handling the products of a number of Fox River Valley mills. All of the present sales force will be retained by the new owners.

Mill Employment Gains Slightly

Employment in Wisconsin paper and pulp mills and allied plants was up 0.3 per cent in June over May, with an increase from 24,000 to 24,100 workers, according to Wisconsin Industrial Commission reports. This status is 2.3 per cent above June a year ago, when there were 23,600 employed.

Curtailed production schedules are reflected in wage reports, however, since the average weekly payrolls dropped 1.5 per cent in June, from the May average of $780,000 to $768,000 in June. A year ago the average was $703,000, hence payrolls were up 9.3 per cent for June, 1942. The average work week has dropped to 40.9 hours, with an average rate of 77.9 cents, or $31.86 per week.

More of a slump was shown in the Milwaukee metropolitan area, where there were 1,948 employees on the June payrolls, a decrease of 3.6 per cent from May, and average weekly payrolls of $55,491, a drop of 8.5 per cent. The average work week was 40.4 hours at 70.6 cents, or $28.49 per week.

Arbitration Provides Wage Increase

As the result of arbitration conducted last week, employees of the Nekoosa-Edwards Paper Company, Port Edwards, Wis., will receive a horizontal wage increase of three and a half cents per hour, retroactive to July 1, 1942. The company had offered three cents during unsuccessful negotiations June 25, retroactive to June 1.

Under the contract with AFL unions, an arbitration board was appointed, consisting of Walter Radke, representing the company, H. F. Nickerson of Milwaukee, Wis., representing the unions, and John B. Chase of Oconto, Wis., as a third party, appointed by Judge Herman J. Severson of the circuit court. The company was represented at the hearings also by Theodore W. Brazeau as counsel.

Appearing for the unions were A. J. Hayes, Milwaukee, International Machinists, Emil Noren, vice-president of the International Brotherhood of Papermakers, and Rasmus Anderson, vice-president of the International Brotherhood of Pulp, Sulphite and Paper Mill Workers.

The unions sought a basic hourly wage increase of ten cents, adjustments in other employee groups, and liberalization of vacation plans. The board granted the three and a half cent increase, and ruled that the vacation plan is to continue without change; also that there would be no adjustments of wage differentials for individuals or groups of employees. The base hourly rate was formerly 60 cents.

To Design Better Packing Cartons

Fifty research workers at the United States Forest Products Laboratory, Madison, Wis., have been assigned the task of designing packing cases and cartons that will take up a minimum of shipping space to help alleviate the shortage of war transportation. Normally, three men deal with this problem. Both wooden cases and cartons are being studied to provide the proper type for various products so there is no waste space. They are visiting numerous plants to make these studies, and then designing containers best adapted to the products. They make tests to decide the minimum of material needed, and make durability tests by means of a revolving drum 20 feet in diameter.

Fingerprinting of Workers Completed

Progress is being made in war precautions in Wisconsin mills. Thilmany Pulp and Paper Company, Kaukauna, Wis., has completed the fingerprinting of 1,150 workers and has turned over the file cards to the Washington office of the FBI. All employees of Kimberly-Clark Corporation have been furnished with identification buttons, which they will be required to wear while on duty.

The Thilmany mill is now flying a "Minute Man" flag because its employees are now purchasing approximately $10,000 worth of war bonds per month under the payroll deduction plan. Another addition to the 100 per cent group for the purchase of bonds and stamps is the Kimberly-Clark Corporation's mill at Kimberly, Wis.

Midwest Reports Paper Market Still Slow

Government Buying Aids Market But Normal Trade Volume Is Not Expected For Some Time—Studies Placticized Paper For Airplanes — May Make Rubber From Sulphite Waste — Other News.

[FROM OUR REGULAR CORRESPONDENT]

CHICAGO, Ill., August 10, 1942—With the exception of government business, Chicago paper jobbers and sales representatives are still maintaining a most quiet position. Recent reports indicate a doubt that the replenishment of diminished inventories will actually be sufficient to bring the paper trade up to a semblance of normal strength for some time to come. Merchants are hesitant in buying paper supplies, both because of their own falling off in business and because of the "shortage" situation which has been dinned into them. Advertising papers are waiting until such times as the "huge demand" in this country makes its appearance, but while waiting they find business reporting a buying uncertainty even among the public which is disconcerting. Other factors such as proposed inventory control, price ceilings and the 1942 Revenue Act are all combining with new interpretative orders on paper to slow up the market. The kraft market is reported as "slow" during the week while fine papers in general found little real interest among buyers. Groundwoods and newsprints were likewise reflecting shrinkage.

Plasticized Paper for Airplanes

Merchants in Illinois and Missouri had their attention drawn, this week, to the possibilities of making airplanes of paper. The McDonnell Aircraft Corporation of St. Louis says planes of paper are by no means an impossibility. The company announced that its engineers have completed successful experiments using laminated paper plastic in the manufacture of wing tips, rudders, elevators, ailerons and other parts. An experimental wing tip made of the plastic was lighter and 40% stronger than aluminum, withstanding 2800 pounds of weight in a test, the company reported. The new material was described as having a smooth surface, eliminating finishing and coating processes, greater resistance to abrasion and denting than aluminum, uniformity and adaptability to curved and tapering forms without special treatment. The shortages reported in aluminum and steel are expected to focus immediate attention on this new paper plastic.

Plan Annual CPA Golf Outing

The Chicago Paper Association, long noted for doing what it does in a most thorough and outstanding manner, has announced its annual golf outing to be held at the now famous Tam O'Shanter Golf Club on September 3. "Tam" is the site of the recent "Hale America" and "war time open" events. The September 3 program was publicized recently by William S. Knox of Knox & Schneider, secretary-treasurer of the Chicago Paper Association. The announcement indicates that a big entertainment program is being prepared and that the paper executives and their guests may not only enjoy golf but swimming and other diversions which the club provides. Lunch, dinner and "plenty of prizes" are all announced as "bait" for the Association and its guests and a huge crowd is expected to adjourn all business for one full day of genuine friendliness and frivolity.

May Make Rubber from Sulphite Waste

A subsidiary of the Chicago Tribune, the Ontario Paper Company, has announced through the *Tribune* that it has applied for priorities on distilling apparatus through which rubber will be made from a paper mill by-product. It was estimated that sulphite liquor, drawn off in production of wood pulp paper, is available in sufficient quantities to make 90,000 tons of synthetic rubber each year—or 10% of the present rubber need. It was stated that such production would come from a heretofore waste product, that there would be no raw material transportation problem because the waste sulphite is already at the mills and present facilities could be utilized eliminating the need for capital expenditures to build new facilities.

Waste Paper Group Meets

The Midstates Waste Paper group held a meeting at the Hotel Sherman, Chicago, on the evening of August 4. It is presumed that the current waste paper situation, which is reported as turning for the better as huge accumulations have slowly diminished, was one of the major topics of discussion.

Announce Zellerbach Personnel

Present personnel of the Chicago division of the Zellerbach Paper Company is listed in the new 160-page price list just issued by that office. G. A. Mueller is manager of operating and mill departments, P. C. Peterson is listed as sales manager with J. A. Dianis and F. M. Johnson managers of the office and credit and announcement departments respectively. Also listed are additions to the sales personnel including G. B. Kraus, Fred H. Strong, Jr., and Luke A. Johnsos. Johnsos is a former Northwestern University "grid great" who now works with the Chicago Bears in an advisory capacity. The division also listed stock additions including Trufect, Kimfect and Multifect Levelcoat book and Old Tavern cover.

Merchants Add New Lines

Regardless of many varied factors, a number of Chicago paper merchants took on new lines during the two weeks just past. Bradner Smith & Co. added Kromekote Litho and Cover from the Champion Mills; Tufwite Tag from the Riegal Paper Corporation and Ta-Non-Ka Duplicator from the Badger Paper Mills. Dwight Bros. Paper Company added Sagamore Tag from Hollingsworth & Whitney and the Mead Sales Company product, Mead Bond. Swigart's announcements list new acquisitions as Engravatone from the Eastern Corporation, Linweave's Patriotic Text and Glossette Enamel from the Watervleit Paper Company.

Government Paper Bids and Awards

WASHINGTON, D. C., August 12, 1942—The Government Printing Office has received the following bids for 382,300 pounds of 44½ x 64 wood manila paper; R. P. Andrews Paper Company, 3.98 cents; Butler Company, 4.5 cents; Graham Paper Company, 4.19 cents; Marquette Paper Company, 4.15 cents; Mudge Paper Company, 4.3 and 4.4 cents; Paper Corp. of U. S., 4.59 cents; Perkins-Goodwin Company, 4.05 cents; Resolute Paper Products Corp., 4.049 cents; Waller Goulard Plehn Company, Inc., 4.45 and 4.15 cents; Whitaker Paper Company, 4.05 and 4.15 cents; Bulkley Dunton & Company, 4.25 cents; Bermingham & Prosser Company, 3.93 and 3.39 cents; Coy Hunt & Company, 4.03 cents; D. L. Ward & Company, 4.15 and 4.5 cents; Fitchburg Paper Company, 4.86 cents; and National Pulp and Paper Company, Inc., 4.25 cents (200,000 pounds only).

For 327,600 pounds of 8 x 10 white offset paper; Marquette Paper Company, 5.36 and 6.25 cents; Walker Goulard Plehn Company, Inc., 6.09 cents; Butler Paper Company, 5.45 cents; Mudge Paper Company, 6.16 cents; Whitaker Paper Company, 5.75 and 5.5 cents; Stanford Paper Company, 5.5 cents; Perkins-Goodwin Company, 6.25 cents; Frank Parsons Paper Company, 5.67 cents; and Aetna Paper Company, 6.89 cents.

For 211,250 pounds of 10½ x 16 white offset paper; Marquette Paper Company, 5.51 and 6.40 cents; Walker Goulard Plehn Company, Inc., 6.59 cents; Butler Paper Company, 6.09 cents; Mudge Paper Company, 6.46 cents; Whitaker Paper Company, 6.15 cents; Stanford Paper Company, 6.15 cents; Perkins-Goodwin Paper Company, 6.15 cents; Frank Parsons Paper Company, 6.17 cents; and Aetna Paper Company, 7.29 cents.

For 119,600 pounds of 24 x 38 white offset paper; Marquette Paper Company, 5.61 and 6.40 cents; Walker Goulard Plehn Company, Inc., 6.59 cents; Butler Paper Company, 6.09 cents; Mudge Paper Company, 6.46 cents; Whitaker Paper Company, 6.15 cents; Stanford Paper Company, 6.15 cents; Perkins-Goodwin Company, 6.15 cents; Frank Parsons Paper Company, 6.17 cents; and Aetna Paper Company, 7.29 cents.

For 6,000 rolls of gummed No. 1 kraft paper, 500 ft. to the roll; Gummed Tape & Device Company, 17.25 per roll; D. L. Ward Company, 17.64 cents less 2%; Whitaker Paper Company, 15.14 cents; Nashua Package Sealing Company, 14.05 cents; Enterprise Paper Company, 14.994 cents; R. P. Andrews Paper Company, 15.3 cents; Mid States Gummed Paper Company, 16.47 cents less 2%; and Perkins-Goodwin Company, 14.94 cents.

For 2,000 sheets of 22 x 28 mist gray photomount board; Mathers-Lamm Paper Company, $52.80 and $53.50 per M sheets; George F. Muth & Company, $55.00; Whitaker Paper Company, $50.50; R. P. Andrews Paper Company, $51.30; and Barton, Duer & Koch Paper Company, $49.00.

Paper Awards

Marquette Paper Company has been awarded the contract for furnishing the Government Printing Office with 136,062 pounds of 25% rag, white bond paper at 11.50 cents. Other paper awards announced recently include the following.

Bulkley Dunton & Company will furnish 75,000 pounds of buff offset paper at 5.5 cents and R. P. Andrews Paper Company will furnish 189,154 pounds of white offset paper at 5.08 cents. Brander Smith & Company will furnish 20,000 sheets of red railroad board at $33.34 per M sheets and the Stanford Paper Company will furnish 25,000 sheets buff railroad board at $53.80.

R. P. Andrews Paper Company will furnish 7,194 pounds of 28 x 38 tan bristol board at $775.22 and the same firm will also furnish 7,262 pounds of 75% rag yellow ledger paper at $1,221.47. Bulkley Dunton & Company will furnish 865,000 pounds of supercalendered book paper at 4.945 cents and the Cauthorne Paper Company will furnish 75,110 pounds of 25% rag, white bond paper at 11.11 cents per cwt.

Marquette Paper Company will furnish 128,000 pounds of white sulphite writing paper at 6.13 cents and Walker Goulard Plehn Company will furnish 200,000 pounds of telephone book news at 4.69 cents.

Marquette Paper Company will furnish 6,750 pounds of 25% rag, white manifold paper at 14.75 cents and the same company will also furnish 120,000 pounds of 25% rag, same at 14.75 cents. Marquette Company will also furnish the following; 8,640 pounds same at 14.76; and 5,130 pounds same at 14.75 cents.

Same firm will also furnish 4,800 pounds of 25% rag, blue manifold paper at 15.96 cents; 6,000 pounds same green at 15.96 cents; 4,050 pounds same yellow at 15.96 cents and 28,000 pounds same yellow at 15.96 cents.

Fitchburg Paper Company will furnish 32,550 pounds of safety sulphite writing paper at 11.25 cents. R. P. Andrews Paper Company will furnish 167,340 sheets and white sulphite writing paper at 5.92 cents and Middlesex Products Corp., will furnish 334,680 sheets of white cloth lined cover paper at $103.50 per M sheets.

Form Pool for War Contracts

TROY, N. Y., August 1, 1942—An industrial pool headed by the Behr-Manning Corporation has been formed here in order to obtain war contracts, according to announcement made this week. The pool brings together several industries employing about 1650 persons with combined assets of over $8,000,000. An agreement has been signed by the members under which the Behr-Manning Corporation, abrasive concern, becomes the bargaining agent or principal in dealing with government agencies. The latter concern will distribute contracts as obtained to all members in proportion to their capacity under prearranged bid prices. Other members of the pool include the Cohoes Envelope Company and the Whitcomb Manufacturing Company, of Troy. John O. Amstuz, chief engineer of the Behr-Manning Company, is the contract officer for the pool. The present production of the plants involved includes abrasives, machine tools, envelopes and paper bags, knitting machines and needles. The combined sales of the companies involved last year totalled $15,000,000.

Obituary

Edward O. Hemstreet

Edward Orlan Hemstreet, sales engineer of The Carborundum Company, died suddenly at his home in Stamford, Ont., Canada, on August 7.

Mr. Hemstreet was born at West Aylmer, Ont. in 1901. He joined the Carborundum organization on April 7, 1924 and after a period of training was sent to a Canadian territory covering the hardware trade. Later he made his headquarters at Montreal and was the Carborundum sales representative there selling grinding wheels and coated abrasive products to the industrial trade. In 1933 he began an intensive study of pulp grinding and pulp grinding wheels and was appointed as sales engineer specializing in this work. Since then Mr. Hemstreet had become an internationally recognized authority on pulp grinding and had a host of friends among the industry.

He is survived by his widow Hilda Hemstreet, a son Arthur, his father and a brother and sister.

Mrs. Jeane H. Gottesman

Mrs. Jeane H. Gottesman, wife of D. Samuel Gottesman, passed away suddenly on July 28, after a brief illness, at the age of 49.

Mrs. Gottesman, who was a co-founder of the D. S. & R. H. Gottesman Foundation, was widely known for her philanthropic activities. She was, during her career, an officer of several national and local charitable institutions. She devoted much of her energies to alleviate the circumstances of the sick and the needy, and played an active role in many educational endeavors.

Her husband is president of Gottesman & Company, Inc., and a director of a number of other corporations.

Surviving besides Mr. Gottesman are three daughters, Mrs. Jerome J. Altman, Mrs. Ira D. Wallach, and Miss Joy Gottesman and three grandchildren.

George F. Fairbanks

[FROM OUR REGULAR CORRESPONDENT]

WATERTOWN, N. Y., August 10, 1942—George A. Fairbanks, 73 years old, for many years prominently identified with the paper manufacturing industry, died this week after an illness of a few months. He was employed as a mechanical engineer by the Carthage Machine Company until late in March when he suffered the stroke. In 1922 he became a draftsman for the Bagley & Sewall Co. and continued in the employ of that concern until late in 1935. While with that concern he was one of three men granted a joint patent covering their invention of a pulley by the government. The principal survivors are his wife and four children.

Paul F. Slattery

Paul F. Slattery, sales manager for the W. Ralston and Company, Inc., manufacturers of waterproof paper, 921 Whirlpool street, Niagara Falls, N. Y., died July 29 in Mt. St. Mary's hospital, after a short illness. A native of East Weymouth, Mass., Mr. Slattery had been connected with the local company about 1½ years. He was 42 years old.

He had been connected with the waterproof paper industry for approximately 22 years and was widely known among manufacturers and builders throughout the eastern section of the country. Surviving are his wife, Mrs. Rose M. Slattery, of the Hotel Niagara, and a brother, William Slattery, of East Weymouth.

Bolling W. Barton

Funeral services for Bolling Walker Barton, 61, president of the Barton, Duer & Koch Paper Company, Baltimore, Md., were held at St. Mark's Episcopal Church. Burial was in Druid Ridge Cemetery.

Mr. Barton, who had been ill several years, died August 1 at his home near Pikesville.

He is survived by his wife, Mrs. Elsie Seeger Barton; two sisters, and four brothers.

W. H. Webster

W. H. Webster, president and treasurer of the Webster Paper and Supply Co., Albany, N. Y., died July 15.

Explains Overseas Paper Containers

WASHINGTON, D. C., August 10, 1942—The Containers Branch of WPB has recently received many questions from packers who are under the impression that a recent order of the Quartermaster Corps to all depots has altered the obligations of suppliers packing commodities for Army use, including items set aside under WPB Order M-86-a.

Douglas Kirk, Chief of the Branch, issued the following statement in answer to such questions:

"The Quartermaster Corps has directed all depots not to ship any items overseas in corrugated or solid fiber boxes unless those boxes are overpacked in nailed wood or wirebound wood boxes. Emergency C, D and K rations are to be overpacked in nailed wood boxes only.

"This decision was made after receipt of complaints from virtually all overseas theaters of operations. The Army is checking into all details including the determination as to whether or not the complaints were due to the use of domestic corrugated or solid fiber boxes.

"Contractors are expected to make deliveries of all Quartermaster supplies in containers as specified in awards. The provisions contained in Order M-86-a have not been changed. Items delivered to the Quartermaster Corps in fiber will be overpacked in wood at Army depots."

J. R. Kimberly Now OPA Assistant

John R. Kimberly, who left his position as director of manufacturing for Kimberly-Clark Corporation, Neenah, Wis., in November, 1941, has achieved a top position in the reorganization of the War Production Board in Washington. He is now one of the two principal assistants to A. I. Henderson, who was named deputy director general for industry operations. Mr. Kimberly went to Washington to become a consultant in OPM's industrial machinery branch. By January, 1942, he was assistant chief of the bureau of industry branches in charge of a group of branches which carried over when WPB took over OPM. The problems with relation to industry production, especially raw materials, flow through Mr. Kimberly's hands.

Instrumentation Studies XL*

Measurement of the Tensile Strength of Paper

Part I: General Considerations of the Factors Affecting this Measurement

By the Staff of the Institute of Paper Chemistry

(Continued from issue of July 30, 1942)

Calibration of Testers

PENDULUM TYPE

Pendulum types of tensile testers are properly calibrated by the so-called deadweight method of loading. The calibration is carried out in the following way: A known weight is hung from the upper clamp of the instrument, the pawls are held in the neutral position out of contact with the teeth of the quadrant, and the pendulum is allowed to reach an equilibrium position. The instrument is then tapped to eliminate any effect of friction and the scale reading noted. In this manner the scale may be checked at as many points as desired. In general, it seems desirable to check the calibration at three widely spaced points at least, before concluding that the calibration is correct. If appreciable errors are found, enough calibration points should be used to allow construction of a correction curve.

The weights must be suspended from the clamp in such a way as to allow the clamp to hang in its normal position. If the weights are not properly balanced, the clamp may be forced to one side or tilted and so cause errors due to friction or other causes not characteristic of normal operation. The difficulty of handling heavy weights may be avoided by fixing a cross-bar in the clamp and suspending several smaller weights from that bar. Account must be taken of the weight of everything hanging from the clamp—i.e., weights, cross-bar, wire, or other devices used in holding the weights. It is obvious that the weights must be known with an accuracy better than that desired in the instrument.

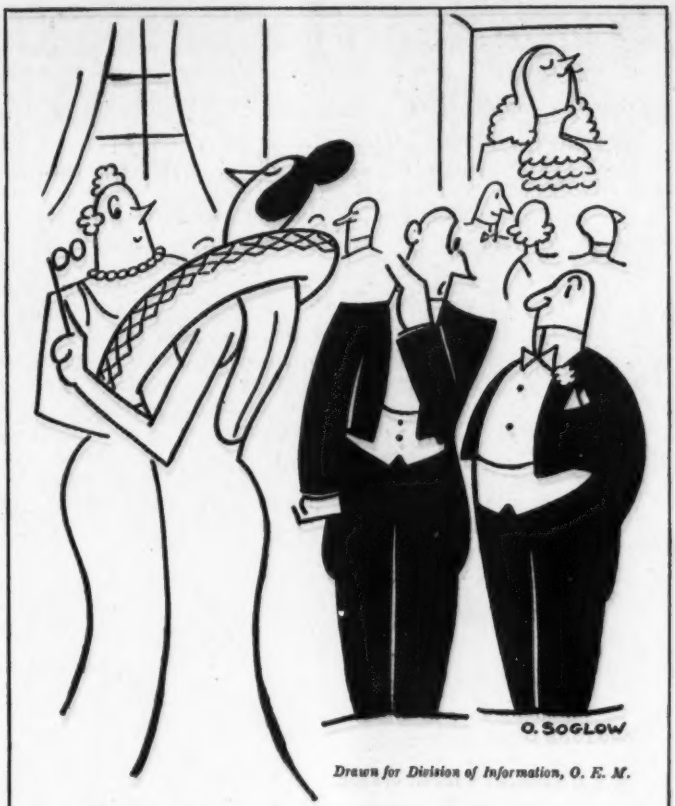
The effect of friction may be examined by loading the upper clamp as stated and, with the pawls arrested, letting the pendulum approach its equilibrium position very slowly without jarring the instrument and noting the equilibrium reading. If friction is present, tapping of the instrument causes the pendulum to swing slightly beyond its first equilibrium position to a new position. The difference in the two readings is an indication of the amount of friction. The effectiveness of tapping in eliminating the effects of friction may be noted by repeating this process by letting the pendulum slowly approach a first equilibrium position from the opposite direction. Tapping should then cause the pendulum to assume the same final position as in the preceding trial. Another method of noting the effect of friction is to arrest the pawls, displace the pendulum from its equilibrium position by a small angle, release it, and allow it to vibrate about the equilibrium position. If frictional effects are pronounced, the motion will be quickly damped and the pendulum will come to rest in a short time after very few oscillations. If frictional effects are not pronounced, the pendulum (unloaded or loaded with a dead weight) will oscillate a number of times before stopping. It is impossible to set a definite standard for the number of times the pendulum should oscillate before stopping after an initial displacement of about two degrees, but it can be said that in an instrument in excellent condition the pendulum should oscillate 50 or more times, whereas in an instrument with considerable friction the pendulum may come to rest after two or three oscillations.

It is sometimes suggested that an instrument be calibrated by suspending a known weight from the upper clamp and then, with the pawls down in operating position, lowering the weight at the same speed as that of the lower clamp during an actual test. The weight is lowered by hand or by letting it rest on the lower jaw and operating the driving mechanism as during a test. The scale reading, noted after the pendulum comes to rest, is taken as the reading corresponding to the known weight used. This method is apparently suggested because of a desire to have the calibrating conditions simulate those of actual testing as closely as possible. The method is incorrect, however, because of its failure in this very respect. When the weight is held in the upper clamp and allowed to move downward, the entire system, pendulum and weight; acquires momentum determined by the mass of the system and the speed of lowering. This momentum and the associated kinetic energy are constant as the weight moves down and the pendulum swings out toward its equilibrium position until the instant at which the pendulum reaches its equilibrium position. This equilibrium position refers to the equilibrium point found by the previously discussed method of dead-weight loading. At that instant there is no force or torque acting to stop the motion and the pendulum coasts past the equilibrium position. As soon as the equilibrium position is passed, a restoring torque, due to the weight of the pendulum, tends to stop the motion. This restoring torque varies; it is zero at the equilibrium position and increases as the pendulum moves beyond the equilibrium point. It is given at any time after passage through the equilibrium position by Equation 8,

$$\text{Restoring torque} = W\,[\sin(\Theta + \Delta\Theta) - \sin\Theta]R, \qquad (8)$$

in which W is the weight of the pendulum, Θ is the angle between the equilibrium position of the pendulum and the vertical, $\Delta\Theta$ is the small angle through which the pendulum has moved after passing through the equilibrium position, and R is the distance between axis and center of gravity of the pendulum. The motion stops when the kinetic energy possessed by the

* This report is one of a series issued as a part of the Instrumentation Program of the American Paper and Pulp Association.



Drawn for Division of Information, O. E. M.

"Mrs. Van Pyster is wearing the family heirloom tonight."

V-20-4/6

Let's not let anybody hang anything on us when it comes to taking good care of our rubber covered rolls. Let's exert every possible effort to keep 'em rolling.

STORING, GRINDING, HANDLING, OPERATION of rubber covered rolls are covered thoroughly in bulletins we have published to help you establish a practical maintenance and conservation program. These bulletins are available to you without cost or obligation along with Roll Service Record Books that make it easy to keep track of grinding data and service life. Write for a supply today.

Stowe-Woodward

THE RUBBER ROLL SPECIALISTS

Newton Upper Falls, Mass.

system at the instant the equilibrium position is reached is converted to potential energy. Therefore, the pendulum must swing beyond the equilibrium position and it cannot return because of the action of the pawls. The phenomenon is illustrated by oscillation of the pendulum about the equilibrium position when the pawls are arrested and the pendulum is slightly displaced from its equilibrium position and released.

The magnitude of this follow-through of the pendulum with loaded clamp is easily determined experimentally. With the pawls arrested, a weight is hung from the upper clamp and the equilibrium scale reading noted. The pendulum is returned to its neutral position, the pawls are released, the lower clamp is raised until in contact with the weight in the upper clamp, and the driving mechanism is operated at the desired speed, thus lowering the weight. The scale reading is noted when the pendulum comes to rest. The difference between this last reading and the first one measures the follow-through of the pendulum. Observations of this sort were made for the 0 — 75-pound scale of a particular instrument with the results presented in Table I. Three loads and three clamp speeds were used. The follow-through is particularly serious at the higher speeds.

TABLE I.—OBSERVED PERCENTAGE INCREASE IN SCALE READING
(Due to follow-through of loaded pendulum)

Clamp Speed in./min.	Load 5.2 lb.	9.0 lb.	24.9 lb.
	%	%	%
2	0.0	1.1	0.2
12	10.6	11.1	3.8
20	10.6	17.8	6.6

The situation is different in actual testing. The tendency of the pendulum to overshoot the position at which the specimen breaks is much less than its tendency to overrun the equilibrium position when a weight is hung from the clamp. As soon as the specimen breaks, the entire torque, due to weight of the pendulum, acts to stop the motion. This torque is of a much greater order of magnitude than the torque acting on a system when loaded with the weight. The extent to which the pendulum overshoots the position at which the specimen breaks (in actual test) was calculated for a typical instrument in the following way:

As previously discussed, the kinetic energy possessed by the pendulum at the instant the specimen breaks is lost by conversion to potential energy as the pendulum coasts beyond the point of breakage and its center of gravity rises. The potential energy gained is measured by the product of the weight W of the pendulum and the distance its center of gravity rises after passing the equilibrium position. The kinetic energy of the pendulum is most conveniently expressed in terms of its moment of inertia I_p and angular velocity φ. Fig. 5 aids in understanding this relationship. As in Fig. 1, O is the axis, G is the equilibrium position of the center of gravity, G' is the final position of the center of gravity, R is the distance from axis to center of gravity, $\Delta\Theta$ is the small angle through which the pendulum coasts past the equilibrium angle represented by Θ, h is the height of rise of the center of gravity, and $R\Delta\Theta$ is the distance the center of gravity moves along the arc as it overruns the equilibrium position. The relative magnitudes of $\Delta\Theta$ and Θ are greatly exaggerated in Fig. 5 for clarity of illustration. Actually, $\Delta\Theta$ will be shown to be less than one degree for the conditions under which paper is tested. The value of h is given by Equation 9:

$$h = R\Delta\Theta \sin \Theta. \quad (9)$$

The potential energy gained by the pendulum is therefore given by Equation 10:

$$\text{Gain in potential energy} = WR\Delta\Theta \sin \Theta. \quad (10)$$

The kinetic energy lost by the pendulum is given by Equation 11:

$$\text{Kinetic energy} = I_p\omega^2/2. \quad (11)$$

The equality of kinetic energy and potential energy is indicated in Equation 12:

$$I_p\omega^2/2 = WR\Delta\Theta \sin \Theta. \quad (12)$$

This equation may be solved for $\Delta\Theta$ with the result shown in Equation 13:

$$\Delta\Theta = I_p\omega^2/2\ WR \sin \Theta. \quad (13)$$

In order to obtain a numerical value for $\Delta\Theta$, the values of the quantities on the right-hand side of this equation must be found.

The values of W and R are inconvenient to measure directly, but the product, $W\ R \sin \Theta$, may easily be obtained by noting that, when a weight w is hung from the upper clamp, the relationship, corresponding to Equation 1, is shown in Equation 14,

$$WR \sin \Theta = wr, \quad (14)$$

in which r has its previous meaning; it was found by measurement to be 0.324 foot. Hence, the value of $WR \sin \Theta$ for any position of the pendulum was the scale reading in pounds multiplied by 0.324.

The moment of inertia of the pendulum was found by making use of the well-known formula for the period of a compound pendulum—i.e., Equation 15.

$$P = 2\pi\sqrt{I/WH}, \quad (15)$$

in which P is the period for vibrations of small amplitude, H is the vertical distance between axis and center of gravity[1], I is the moment of inertia and W is the weight of the compound pendulum. In applying this formula to the calculation of the moment of inertia, a known weight w was hung from the upper clamp, the pawls were arrested, and the pendulum allowed to oscillate through a small angle about its equilibrium position. The time for 50 complete vibrations to be performed was measured with a stop watch and from that value the period P was found to be 1.60 seconds. The moment of inertia I

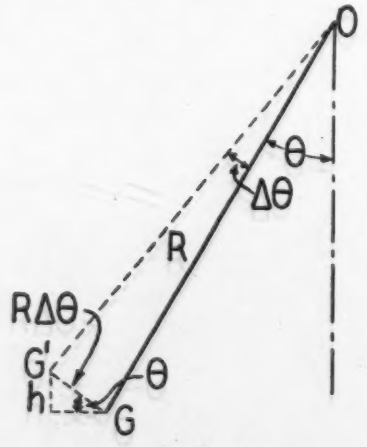


FIG. 5
Schematic Drawing of Pendulum-Type Tensile Tester for Discussion of Energy Changes

of the compound pendulum formed by the instrument pendulum and the weight is related to the moment of inertia of the instrument pendulum alone, I_p and the moment of inertia of the weight alone $w\,r^2/g$, as shown in Equation 16:

$$I = I_p + wr^2/g \qquad (16)$$

Since the torque exerted by the weight w is independent of the position of the pendulum, the center of gravity of the compound pendulum is also the center of gravity of the instrument pendulum and H is given by Equation 17:

$$H = R \cos \Theta. \qquad (17)$$

Equation 15 may be solved for I, and Equation 18 results:

$$I = P^2WH/4\pi^2 \qquad (18)$$

Replacing I by its value from Equation 16, H by its value from Equation 17, and WR by its value from Equation 14, and solving for I_p, Equation 19 is obtained:

$$I_p = (P^2\,wr \cot \Theta/4\pi^2) - wr^2/g. \qquad (19)$$

The moment of inertia of the instrument pendulum may thus be calculated from known values of P, w, r, and Θ. The average value found for the particular instrument examined was 1.94 slug feet[2].

The value of ω in Equation 13 is related to the speed v of the clamp in the manner shown in Equation 20:

$$v = r\omega. \qquad (20)$$

Equation 13 may now be rewritten as Equation 21, replacing ω by its value from Equation 20 and WR sin Θ by its value from Equation 14:

$$\Delta\Theta = I_p\,v^2/2\,wr^2. \qquad (21)$$

Since I_p and r are known, Equation 21 permits calculation of the angle through which the pendulum will coast when the clamp is moving with a speed v and the specimen breaks at a load w. The angle is given in radians[2] when I_p is in slug feet[2], v is in feet per second, w is in pounds, and r is in feet. It is noteworthy that $\Delta\Theta$ is proportional to the square of the clamp speed and is inversely proportional to the load.

Equation 21 was used to calculate values of $\Delta\Theta$ for several combinations of load and clamp speed. These values were converted to scale readings by calculating the linear displacement of the pointer which corresponded to each value of $\Delta\Theta$ and then converting this linear displacement to the appropriate change in scale reading. Table II lists the values so obtained, expressed as percentages of the corresponding loads.

The extent of the follow-through is seen to be negligible at clamp speeds of three inches per minute or less but is serious for higher speeds and small loads. These calculations were made for the 0—75-pound scale of the instrument. Since tensile strengths of 10 pounds or less would ordinarily be measured on the lower range scale (0—15-pound), for which the percentage follow-through would be even less, it appears that the coasting of the pendulum after the breaking of the specimen causes a negligible error at clamp speeds of 12 inches per minute or less. In testing paper on the 0—75-pound scale, there appears to be no need for using clamp speeds greater than 12 inches per minute and many tests are run at lower speeds.

TABLE II.—CALCULATED PERCENTAGE INCREASE IN SCALE READING DUE TO FOLLOW-THROUGH OF PENDULUM AFTER FAILURE OF SPECIMEN
(Calculated to nearest 0.1% for 0—75-pound scale)

Clamp Speed in./min.	Load 5 lb.	10 lb.	15 lb.	20 lb.	25 lb.	30 lb.
	%	%	%	%	%	%
3	0.2	0.0	0.0	0.0	0.0	0.0
6	0.8	0.2	0.1	0.1	0.0	0.0
9	1.6	0.4	0.2	0.1	0.1	0.0
12	3.0	0.7	0.3	0.2	0.1	0.1
15	4.6	1.2	0.5	0.3	0.2	0.1
18	6.8	1.7	0.7	0.4	0.3	0.2

Comparison of Tables I and II shows the error in assuming that the conditions of paper testing are simulated when a pendulum-type instrument is calibrated by loading the upper clamp and allowing the weight to move downward with the clamp speed used in actual testing. In addition, this loading technique does not correct for friction in the instrument. Table I shows that the follow-through of the loaded clamp and pendulum varies with clamp speed and load. Therefore, correction of frictional effects by this calibrating technique would be an excessively involved process, as it would be fortuitous indeed if friction varied in the same manner.

In the pendulum type of instrument vibration is particularly undesirable. If the pendulum moves jerkily or vibrates in its plane of motion, the specimen is subjected to repeated shocks and the observed tensile strength is decreased. In case vibration occurs only in a plane perpendicular to that of the pendulum motion, its effect may not be serious. In general, however, an instrument which vibrates does so in such a way as to cause some vibration in the plane of the pendulum.

Inclined-Plane Type

The inclined-plane type of tensile tester is also properly calibrated by dead-weight loading, although the technique is different and somewhat more complicated than that used with the pendulum type of tester. The fixed clamp is removed, if necessary, and a pulley is fastened to the upper end of the inclined plane in such a position that a cord or fine wire fastened to the clamp on the carriage of the instrument passes over the pulley and hangs freely and vertically, so that the calibrating weight may be fastened at the end of this wire or cord. The portion of the wire or cord lying between the clamp and the pulley must be strictly parallel to the direction of motion of the carriage. The pulley should be as frictionless as possible and the wire or cord should be light and flexible. When a weight is hung from this cord, there is, in a frictionless instrument, only one position of the plane at which the carriage will remain at rest. If given a slight push in either direction, the carriage will move with a constant speed, provided that the plane is at the equilibrium angle. If the plane is inclined too steeply and the carriage is pushed downward, the speed increases. If the plane angle is too small, the carriage will slow down and stop when given a slight push in the downward direction. The equilibrium position is one of neutral rather than of stable equilibrium, as was the case in the pendulum type of tester. The inclined-plane tester must therefore be calibrated by the method of trial and error. A known weight is suspended from the wire passing over the pulley and the position of the plane is adjusted by small steps until the point is reached at which the carriage moves

[1] For the system described in this paragraph, the distance H, as defined, is used in Equation 15 when W alone, and not $(W + w)$, appears in this equation. If the total weight $(W + w)$ were used in the equation, H would be defined as the vertical distance between axis and center of gravity of the pendulum *and* weight w, the center of gravity of the weight w being considered in the horizontal plane containing the axis of rotation.

[2] 2π radians = 360 deg., or, approximately, 1 radian = 57.3 deg.

with constant speed in either direction when started in that direction. If there is an appreciable amount of friction in the instrument, the angle of the plane at which the carriage moves downward with constant speed and the angle at which it moves upward with constant speed are not the same. The average of the two positions so found is the true position of equilibrium and the corresponding scale reading is the scale reading corresponding to the dead-weight load. The difference between the scale reading for the position in which the carriage moves downward with constant speed and the average of the two scale readings is a direct measure of the friction in the instrument including the friction in the pulley. This friction is not necessarily constant for various scale readings—i.e., for various angles of the plane—so that, if a correction is desired for the effect of friction, this method of calibration should be carried out at several points along the scale to determine whether or not the force of friction varies for various positions of the plane. If friction is found to be appreciable correction may be made by subtracting the observed frictional force from the scale reading at any particular position, in addition to making any other corrections which may be necessary because of improper calibration of the scale. The friction in the pulley should be independently determined and its value subtracted from the total frictional force found by the above method. The friction in the pulley may be found by suitably mounting the pulley, suspending equal weights from the two ends of a wire or cord passing over the pulley, and noting the additional weight which must be added to one side to cause that weight to move downward and the other weight to move upward with constant speed when the first weight is started downward. The friction of the pulley may vary with the load applied to it; hence, it should be tested at each load used in calibrating the instrument.

It is not sufficient to consider, as one manufacturer suggests, that calibration has been effected when the carriage is weighed and found to have its prescribed weight, because the calibration of the scale or chart is then not tested.

Hydraulic Type

Tensile testers employing the hydraulic type of loading mechanism may be calibrated in a manner analogous to that used for the pendulum type of tester. Dead-weight loads may be hung from the clamp which operates the loading mechanism either directly or, if necessary, by a cord passing over a pulley. Friction may be observed and, in addition, there may be the effect of hysteresis or fatigue in the gage if it is of the Bourdon type and in the diaphragm if the instrument is of the diaphragm type.

The instrument should be calibrated as a unit, not by merely calibrating the detached pressure gage. The gage scale is calibrated to indicate the load applied to the instrument; this load is not necessarily the actual pressure in the cylinder, because the relative values of pressure and load depend on the cross-sectional area of the cylinder.

Spring Type

The spring type of instrument is calibrated by dead-weight loading in a manner analogous to that already described for the pendulum and hydraulic types.

Effect of Rate of Loading

In the tensile testing of a wide variety of materials it is found that the observed tensile strength depends upon the rate at which the specimen is loaded, the tensile strength increasing as the rate of loading increases. In the testing of metals this effect is associated with the flow of the metal under the applied stress; in the testing of paper and other fibrous sheet materials the effect is associated with the relative movement and yielding of fibers under the applied stress.

This variation in the observed tensile strength with rate of loading requires some standardization of the testing method if results obtained with various instruments and at various laboratories are to be strictly comparable. The first suggestion for improving the uniformity of testing methods was that the speed of the stressing jaw be constant and specified. The present TAPPI Standard (T 404 m-36) specifies that the speed of the stressing jaw be 12 inches per minute. Pendulum-type tensile testers, the only type to which this method of standardization applies are made with pendulums of widely varying moments of inertia and widely varying ranges. Consequently, a fixed speed of the stressing jaw may yield greatly varying rates of loading for different instruments. In general, tensile testers are equipped with two pendulum weights, yielding two moments of inertia for the pendulum and, therefore, constant speed of the stressing jaw does not cause constant rates of loading for the two scales of a particular instrument. Hence, this standardization of technique through specification of the speed of the stressing jaw fails to achieve its purpose unless all tests are carried out on instruments of similar design and range. Carson *(2)* has suggested that the rate of loading rather than the speed of the stressing jaw be specified—i.e., that the specification consist of a statement that the load shall increase at so many pounds or kilograms per second rather than that the speed of the stressing jaw shall be so many inches per minute. Standardization according to this suggestion would be applicable not only to pendulum-type tensile testers but to testers of all types. The Paper Testing Committee of TAPPI (Technical Association of the Pulp and Paper Industry) is currently considering using a rate of loading of 1 ± 0.32 pound per second for papers having tensile strengths greater than five pounds. For weaker papers the rate of loading suggested is lower. Also the recommendations of the Paper Testing Committee of the Technical Section of the Paper Makers' Association of Great Britain and Ireland *(3)* are in line with this suggestion. They have specified that the rate of loading shall be between 0.5 and 1.0 pound per second on scales covering the range from 0 to 14 pounds and shall be 1.0 to 1.5 pounds per second on scales ranging from 0 to 70 pounds. The choice of the proper rate of loading is a difficult one to make. Thin and weak papers must be tested at a rate of loading so low that the application of the load does not remotely resemble an impact. A rate of loading satisfactory for these thin papers is so low that the time of test for strong papers becomes undesirably large. This trouble is partially eliminated by specifying two rates of loading, one for weak papers and one for strong papers, as mentioned in the recommendations above. This compromise is objectionable in some instances—e.g., in pulp testing or for some research purpose it may

The Navy "E" awarded to our employees

A letter we were very happy to receive

THE SECRETARY OF THE NAVY
WASHINGTON

May 20, 1942

Dear Mr. Swigert:

To give full credit where it is justly due is one of the fundamentals of the Naval Service. It is, therefore, my duty, as well as my great pleasure, to advise you that the Electric Steel Foundry Company has been selected by the Navy Board for Production Awards to receive the Navy "E" for excellence in industrial production.

For almost forty years the "E" has been the Navy's symbol of a job well done. I can think of no honor more highly respected among the officers and men of the Fleet.

In token of the service your company has rendered the nation, you now have the right to fly the Navy "E" pennant over your plant. Your fellow-workers in the offices and at the machines are privileged to wear the Navy "E" lapel insignia.

Our battle-fronts are not only on foreign soil. We have a battle-front right here — the battle for production of war materials. Congratulations to you and your soldiers of production for your significant contribution toward winning this increasingly important home battle. Keep up the good fight! For in this most critical war in our nation's history, the first great victory must be won on the line of supply.

Yours sincerely,

Frank Knox

Mr. C. F. Swigert, Jr., President
Electric Steel Foundry Company
2141 North West 25th Avenue
Portland, Oregon

In normal times ESCO products are used in many of the country's industries; in logging and sawmill operations, pulp and paper mills, mines and smelters, cement plants, and in highway, dam and bridge construction; products requiring the highest quality of castings and fabrication, such as stainless steel digester equipment, dipper and dragline buckets, manganese chain and rigging, and crusher equipment.

The skilled workmen, metallurgists, and other technical men, who have made it possible for us to tackle the tough jobs of peacetime, are now making it possible for us to successfully accomplish the tough jobs of war-time which the Navy has called upon us to do.

We are PROUD of our "SOLDIERS OF PRODUCTION" and their doubled and redoubled efforts.

We recognize the Navy "E" award as a challenge to even greater efforts.

ELECTRIC STEEL FOUNDRY, Portland, Oregon

Branches at Seattle, Eugene, San Francisco, Los Angeles, Honolulu

be desirable to follow the changes in tensile strength with beating or some other operation. If the tensile strengths of the specimens range through the region in which the rate of loading is changed, there will be a break in the relationship between the processing variable and the tensile strength.

Clark *(4)* has suggested another variation in the method of standardization—namely, that the time of the test rather than the rate of loading or the speed of the stressing jaw be held constant. The Paper Testing Committee of TAPPI is currently considering such a revision of the standard testing method for very weak papers—i.e., those with a tensile strength less than 5 pounds.

In order to amplify existing information on the change in tensile strength with rate of loading, the tests now to be described were carried out for six papers of widely varying strength using a motor-driven Schopper tensile tester, the stressing jaw of which could be driven at speeds continuously varying from 2 to 20 inches per minute. Each paper was tested in each of its two principal directions at stressing jaw speeds of 3, 6, 9, 12, 15, and 18 inches per minute. The test specimens were 15 mm. wide and 250 mm. long. Sampling was effected by taking 200 specimens from each paper in each of the two principal directions; each group of 200 specimens was thoroughly mixed and sorted into six groups, one of which was tested at each of the above-mentioned speeds. Thirty tests were made for each speed; no specimens having obvious flaws or watermarks were tested. Results from tests in which the specimen broke in or at the jaw were discarded. The separation of the clamping jaws was 180 mm.; the time which elapsed between the first application of the load and rupture of the specimen was measured with a stop watch. All samples were conditioned for at least six hours and all tests were carried out at a relative humidity of 65% and a temperature of 70 deg. F. Table III describes the samples, and lists the average tensile strength observed at each of the six rates of loading. The asterisked values were obtained on the 0—15-pound scale; all other values were obtained on the 0—75-pound scale.

TABLE III.—DEPENDENCE OF TENSILE STRENGTH ON SPEED OF STRESSING CLAMP
(Tensile strength in pounds)

Sample	Caliper 0.001 in.	Basis Wt. 25x40 –500 lb.	Inches per Minute 3	6	9	12	15	18
			Machine Direction					
Sulphite test liner	17.7	234	61.5	62.5	62.5	65.2	65.7	65.8
Kraft folder	10.9	136	44.4	45.4	46.2	46.8	47.2	46.8
Sulphite ledger	6.1	91	31.0	31.8	31.9	32.4	33.1	33.2
Rag-content bond	3.8	34.5	19.1	19.8	20.0	20.2	20.8	20.7
Sulphite envelope	4.2	66	12.9*	13.4*	13.5*	13.8*	13.7*	13.7*
Waxing stock	1.6	27.2	5.27*	5.41*	5.54*	5.50*	5.72*	5.71*
			Cross Direction					
Sulphite test liner	17.7	234	13.2*	13.7*	13.9*	13.7*	13.9*	14.0*
Kraft folder	10.9	136	24.3	25.5	25.5	25.5	25.9	25.9
Sulphite ledger	6.1	91	14.5	14.7	15.0	15.3	15.3	15.1
Rag-content bond	3.8	34.5	9.67*	9.91*	10.1*	10.1*	10.2*	10.4*
Sulphite envelope	4.2	66	7.60*	7.87*	8.14*	8.10*	8.31*	8.31*
Waxing stock	1.6	27.2	2.67*	2.74*	2.73*	2.87*	2.85*	2.96*

* Values obtained on the 0—15-pound scale.

The data indicate a definite increase in tensile strength with increase in rate of loading. However, since interest rests in the intrinsic property of the paper and not only in the experimental observations, account must be taken of the follow-through of the pendulum discussed in the preceding section on calibration. Referring to Table II (which refers to the particular instrument used in these tests) and remembering that the percentage follow-through for the 0—15-pound scale is somewhat less than that at corresponding points on the 0—75-pound scale, it appears that, from a practical point of view, the tensile strengths listed in Table III need no correction for follow-through. Hence, the trend shown in Table III is a bona fide characteristic of the paper. Table IV lists the percentage changes in tensile strength calculated on the basis of the tensile strength at a three-inch-per-minute speed. These data show that increasing the rate of loading by a factor of six increases the tensile strength from 4 to 10%. The plotted points do not define a smooth curve, but the variations from a smooth curve are of the order to be expected in the measurement of the physical properties of paper. The length of the vertical lines drawn through the points plotted in Fig. 6 for the kraft folder indicate the range of the percentage probable errors in the mean values of the tensile strength. The probable error r_m in the mean values was calculated from Peter's formula,

$$r_m = (0.8453\Sigma x)/(n\sqrt{n-1}), \qquad (22)$$

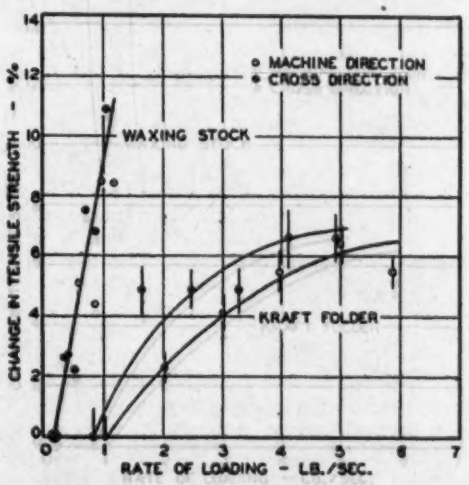


FIG. 6
Dependence of Tensile Strength on Rate of Loading

TABLE IV.—CHANGE IN TENSILE STRENGTH WITH RATE OF LOADING

Sample	3 in./min. Rate lb./sec.	3 in./min. Tensile Change %	6 in./min. Rate lb./sec.	6 in./min. Tensile Change %	9 in./min. Rate lb./sec.	9 in./min. Tensile Change %	12 in./min. Rate lb./sec.	12 in./min. Tensile Change %	15 in./min. Rate lb./sec.	15 in./min. Tensile Change %	18 in./min. Rate lb./sec.	18 in./min. Tensile Change %
					Machine Direction							
Test liner	0.96	0.0	1.91	1.6	2.61	1.6	3.26	6.0	3.73	6.8	5.80	7.0
Kraft folder	1.03	0.0	2.04	2.3	3.02	4.1	3.99	5.5	5.00	6.4	5.89	5.5
Ledger	1.04	0.0	2.07	2.6	3.02	2.9	3.98	4.5	5.08	6.8	6.06	7.1
Bond	0.82	0.0	1.62	3.7	2.39	4.7	3.14	5.8	4.10	8.9	4.92	8.4
Envelope	0.20	0.0	0.40	3.9	0.59	4.7	0.78	7.0	0.99	6.2	1.17	6.2
Waxing stock	0.20	0.0	0.41	2.7	0.60	5.1	0.79	4.4	0.99	8.5	1.18	8.4
					Cross Direction							
Test liner	0.19	0.0	0.38	3.8	0.56	5.3	0.74	3.8	0.93	5.3	1.11	6.1
Kraft folder	0.83	0.0	1.68	4.9	2.50	4.9	3.29	4.9	4.13	6.6	4.93	6.6
Ledger	0.77	0.0	1.57	1.4	2.31	3.4	3.03	5.5	3.95	5.5	4.86	4.1
Bond	0.16	0.0	0.32	2.5	0.49	3.5	0.64	3.5	0.81	5.5	0.96	7.6
Envelope	0.19	0.0	0.38	3.6	0.55	7.1	0.74	6.6	0.94	9.3	1.12	9.3
Waxing stock	0.18	0.0	0.35	2.6	0.52	2.2	0.70	7.5	0.88	6.8	1.05	10.9

in which Σx indicates the sum of the deviations of individual values from the mean, without regard for algebraic sign; n is the number of individual values used in calculating the mean; in this case $n = 30$. It will be remembered that the probable error in any quantity is the error within or without which repeated observations of that quantity will fall with equal frequency.

The range of stressing clamp speeds and the rates of loading used in these tests are sufficient to permit a comparison of tensile strengths obtained with *(a)* the TAPPI Standard of constant stressing clamp speed of 12 inches per minute, *(b)* Clark's suggestion of a constant testing time of 20 ± 10 seconds, and *(c)* the suggestion of a constant rate of loading of 1 ± 0.32 pound per second. Table V lists the tensile strengths selected for this comparison. In the column headed "TAPPI" are listed the tensile strengths obtained with the stressing clamp speed of 12 inches per minute. Under the column headed "Clark" are listed the tensile strengths obtained at such rates of loading that the time of test was closest to 20 seconds. The time of test differed from 20 seconds by no more than three seconds for any of the values listed. The column headed "constant rate of loading" lists the tensile strengths for the tests which most nearly approached a value of one pound per second. None of these actual rates of loading differed by more than 0.23 of a pound from the standard rate of one pound per second. The differences between the values listed in Table V are consistent with the demonstrated effect of rate of loading upon tensile strength.

From a theoretical viewpoint, it is to be expected that the observed tensile strength will decrease as the specimen length is increased. This expectation is based upon the fact that the probability of including an area whose strength is much lower than average increases as the specimen length increases, and the old adage—a chain is no stronger than its weakest link—applies. This consideration, together with practical experience, has led to efforts at standardization of the specimen length. In the TAPPI Standard for measuring the tensile strength of paper, the length of a specimen is limited by specifying that the specimen width shall be between 0.5 inch (12.7 mm.) and 1.0 inch (25.4 mm.) and that the ratio of the length to the width of the specimen shall not be less than 5 to 1 nor more than 12 to 1. The British Paper Makers' Association has adopted a standard length of 180 mm., and German and Swedish testing laboratories also use that length. The Paper Testing Committee of TAPPI is currently considering the adoption of a standard length of 180 ± 10 mm.

TABLE V.—COMPARISON OF TENSILE BY TAPPI STANDARD AND PROPOSED REVISIONS

(Tensile strength in pounds)

Paper	TAPPI	Clark	% Deviation from TAPPI	Constant Rate of Loading	% Deviation from TAPPI
		Machine Direction			
Test liner.....	65.2	65.2	0.0	61.4	—5.8
Kraft folder....	46.8	45.4	—3.0	44.4	—5.1
Ledger	32.4	31.8	—1.9	31.0	—4.3
Bond	20.2	19.1	—5.4	19.1	—5.4
Envelope	13.8	13.8	0.0	13.7	—0.7
Waxing stock...	5.50	5.27	—4.2	5.72	4.0
		Cross Direction			
Test liner.....	13.7	13.7	0.0	13.9	1.5
Kraft folder....	25.5	25.5	0.0	24.3	—4.7
Ledger	15.3	14.5	—5.2	14.5	—5.2
Bond	10.1	10.1	0.0	10.4	3.0
Envelope	8.10	7.87	—2.8	8.31	2.6
Waxing stock...	2.87	2.67	—7.0	2.74	—4.5

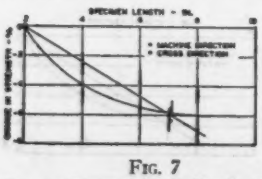


FIG. 7

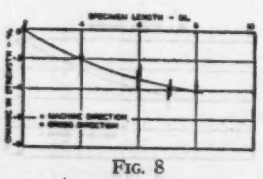


FIG. 8

Fig. 7—Dependence of Tensile Strength on Specimen Length, Kraft Folder. Fig. 8—Dependence of Tensile Strength on Specimen Length, Rag Content Bond.

The dependence of tensile strength on specimen length has been studied by a number of investigators. Oliver *(5)* tested 5- and 18-cm. lengths of three papers. Houston *(6)* tested five lengths (50, 90, 100, 150, and 180 mm.) in each of the two principal directions of the sheet for each of 10 papers using four widths (¼, ½, ¾, and 1 inch). The Paper Testing Committee of the Technical Section of the Paper Makers' Association of Great Britain and Ireland *(3)* reported tests on three lengths (2, 6, and 7 inches) of 22 papers in each of their two principal directions. Harrison *(7)* tested 100- and 180-mm. lengths of two kraft papers. Oliver, Houston, and the Paper Testing Committee found the tensile strength to decrease with increase in specimen length. Harrison found a decrease for one paper and an increase for the other.

Table VI presents some additional information on this dependence of tensile strength on specimen length. The specimens used in these tests were 15 mm. wide. Sampling was effected by cutting 150 specimens in the desired direction for each paper, shuffling this collection of specimens, and dealing into five groups of 30 specimens each. One group of specimens was tested at each of the lengths, 2, 4, 6, 7.09, and 8 inches; no specimens having obvious flaws or watermarks were tested. The tests for each length of specimen were carried out at a rate of loading of one pound per second, except for those specimens which had a tensile strength of less than five pounds for which a rate of loading of less than one pound per second was used. Results of tests in which specimens broke at or in the jaws were discarded. The variation of tensile strength with length of specimen is shown graphically in Figs. 7 to 8 in which the relationship between the percentage decrease (based on the two-inch length) in tensile strength and specimen length is shown. The vertical lines drawn through the points plotted in Figs. 7 and 8 indicate the range of the percentage probable errors in the plotted value. These data corroborate the findings of previous investigators as well as the theoretical prediction in that the tensile strength definitely decreases with increasing specimen length. The relationship between change in tensile strength and specimen length is not sufficiently regular to warrant the calculation of a correction factor by which the tensile strength observed at any specimen length may be reduced to corresponding values for another specimen length.

Since the change in tensile strength with specimen length is related to the frequency of occurrence of weak spots in the specimen, it might be expected that papers of good and poor formation would behave quite differently. It is for this reason that two samples of sulphite bond and two samples of S.C. book paper were selected. The sulphite bond no. 1 was of average formation, whereas sulphite bond no. 2 was of poor formation; likewise S.C. book no. 1 was of good formation and S.C. book no. 2 was of poor formation. The data allow no distinction to be drawn between these papers of good and poor formation.

(To be concluded)

Issue Instructions on Wires

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., August 12, 1942—Pulp and paper mill wire weavers were given additional instructions today on how to file PD-25A applications for materials for paper machine wires under the Production Requirements Plan.

The instructions, issued by the Pulp and Paper Machinery Section, are based on the Wire Cloth Plan developed by the Section over a period of several months.

It was pointed out that applicants in the United States and Canada are not required to break down wire containing copper into different sizes. All the wire can be grouped into one figure. However, in addition to total quantity of wire, the amount of copper contained in the wire must be shown with maximum approximations of tin and zinc.

The Wire Cloth Plan determined the amount of copper, tin, and zinc to be used in the wire formula for wire cloth for operation at 100 per cent production. This figure was determined by a study of wire shipments of all the companies in the United States and Canada to the mills during the years 1939, 1940, 1941 and the first part of 1942, and was 1905.4 tons of copper, 82.89 tons of tin, and 164.71 tons of zinc.

Using these figures as a base, when the PD-25A applications are received every three months, the rate of operation of the pulp and paper industry is determined. The basis of the plan, is that if the permitted operation is 100 per cent, the full quota of copper, tin, and zinc is allowed each wire weaver's application. If the industry is to run at 70 per cent of production, only 70 per cent of each company's quota will be allowed, etc.

It is expected that a high enough preference rating will be made available so that there will be a continuous flow of wire cloth to the mills, sufficient to maintain pulp and paper production at the desired wartime level.

The Metals Control Office of the Canadian government has concurred in WPB's telegraphic order of May 23 halting shipments of paper machine wires except to plants that have an inventory of only four wires per machine in addition to one on the machine. This order is designed to put all mills on equal footing.

Mills which feel that the order will work a hardship on them, may appeal to the Pulp and Paper Machinery Section and receive special instructions.

Raw Materials Short in Ireland

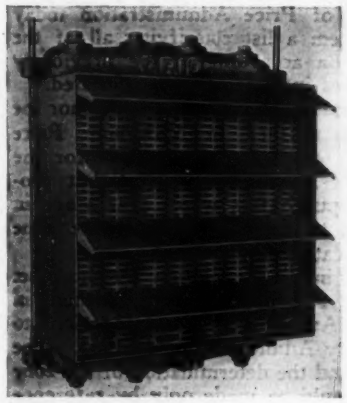
WASHINGTON, D. C., August 12, 1942—Paper manufacturers in Ireland are faced with difficulties in securing raw materials according to a report to the Department of Commerce. Recent attempts have been made to supplement supplies of waste paper as raw material for newsprint and for other papers.

The report says that because of the difficulties Irish newspapers are now using only 15 per cent of the newsprint used by them during the first eight months of 1939. No new periodicals or newspapers will be published, and those in existence will appear at no more frequent intervals than they did during 1940.

Paper mills have been attempting to purchase pulp supplies from Sweden, the report states, the supplies to be shipped to a Portuguese port, and loaded there on Irish steamers.

Made with Cast Iron Heating Sections

To cooperate with the war-effort in using substitute materials the "Grid" Unit Heater is now being made with cast iron heating sections instead of aluminum heating sections. One of the new units is illustrated here. It is engineered along the same lines as the "Grid" aluminum heating sections, and engineered and constructed to withstand up to 250 lb. steam pressure. The War Production Board has permitted the use of cast iron in this new unit heater, as a substitute for cast aluminum that since 1929 has successfully been used in the "Grid" Unit Heater. Being constructed of cast iron this new unit is also free from electrolysis that causes corrosion, leaks and breakdowns, as only one type metal comes into contact with steam or hot water. The manufacturer states that for stability and service the new cast iron unit will be entirely dependable in operation. It is a product of the D. J. Murray Manufacturing Company, Wausau, Wis. For the present this new unit will be made in eight sizes. Being of a special design, application for patent, has been filed by the manufacturer.



New Literature

Slitting, rewinding and uniform tension unwinding machines, are discussed in a folder issued by the Johnstone Engineering and Machine Company, Downingtown, Pa. It describes the company's equipment for faster production of essential war materials. Included are Models 5 and 15, which are new machines. The Model 15 rewinds large diameter rolls and can be equipped with slitters for trimming or for slitting three or four strips.

Measuring and integrating the flow of water, steam and other fluids, is the subject of Catalogue N28-160, issued by the Leeds & Northrup Co., 4934 Stenton avenue, Philadelphia, Pa. It describes in detail the Centrimax Flowmeter, which operates dependably, is easily installed and provides an accurate method in determining and maintaining water and stem flow in industrial plants.

A "Trouble-shooter" for correcting threading pipe failures, is issued in folder form by the A. M. Byers Co., Pittsburgh, Pa. These charts provide a clear explanation of frequently occurring failures and give remedies for correctly fitting pipe screw joints.

Pump design and application, in the form of a reprinted article by H. Gartmann, from *Machine Design*, has been issued by the De Laval Steam Turbine Company, Trenton, N. J. This is a discussion presenting an elementary analysis of centrifugal pump performance. It explains the influence of blade angles and of the areas of wheel passages upon the head-capacity curve, by simple diagrams.

OPA Issues Newsprint List

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., August 12, 1942—In order to assist printers and publishers to determine the zone price differentials applicable in their purchases of newsrint, the Office of Price Administration today made available to them a list classifying all of the counties of the nation according to the previously established price zones in which they are located.

The list does not change the ten price zones nor the zone differentials established in Maximum Price Regulation No. 130, which fixed top prices for the sale and purchase of standard newsprint, but provides a method for purchasers whose plants are in zone-boundary areas to determine readily the zone in which they are located.

The zones defined in the Regulation are those set up for the industry, and used by it since then, in the Newsprint Code Authority's recommendations to the National Recovery Administration in 1933. The zones were mapped and the determination of the zone location for a city could be made only by reference to a footnote list which accompanied the map. This list included each city in which a daily newspaper was published and designated the zone in which that city was located.

The list published by OPA today is based on counties rather than cities. Accordingly, those areas which are on or near zone boundaries can be definitely placed as to zone according to the state or county in which they are located rather than proximity to the cities referred to in the footnote accompanying the zone map. The several exceptions to country-wide zones are specifically listed.

The list does not change the zone locations for daily newspapers, since OPA plotted the cities referred to in the map according to counties in which they lie, but it will serve those persons, particularly many publishers of weekly papers in small towns, who need to know the geographical location of these zones and the differentials in price applying between zones.

Those desiring a copy of the list designated as 'Newsprint Zones by Counties' may secure one by addressing their requests to the Duplicating and Distribution Section, Room 1302, Temporary Building "D", Office of Price Administration, Washington, D. C.

OPA also pointed out that the $50.00 delivered port price frequently referred to, is the manufacturer's maximum selling price for rolls and may be subject to zone and other specific differentials, as well as merchant's markup as described in Regulation No. 130.

Junior Forest Wardens Praised

VANCOUVER, B. C., August 3, 1942—The splendid work being done by Junior Forest Wardens in British Columbia is rapidly gaining recognition outside British Columbia, and the movement promises to spread along the Pacific coast and throughout Canada.

At a meeting of the Canadian Forestry Association in the Terminal City Club, Vancouver, B. C., a letter was received from P. J. Jennings, superintendent of Banff National Park asking for co-operation in organizing junior forest wardens there. It is hoped to have the project under way next season.

The State of Washington, with the assistance of the association in British Columbia, organized the movement last year, with satisfactory results.

Complete information regarding the organization of the Junior Forest Rangers of British Columbia was also requested in a letter from the "Keep Oregon Green" association, Salem, Ore. The letter commented on the marked success of the junior wardens movement in B. C.

W. H. McLellan, president of the B. C. branch, asked for more financial help for educational work among the junior rangers and the public.

C. D. Orchard, chief forester for B. C., praised the work of the association and the junior wardens.

A report on the activities of the association was given by Charles Wilkinson. He stated that the organization's lecture car has completed a tour of Vancouver Island and the northern interior, and will soon cover the southern interior. Mr. Wilkinson indicated his willingness to visit Banff to assist in organizing the movement in the national parks.

N. P. T. A. Cancels Convention

A. H. Chamberlain, executive secretary of the National Paper Trade Association, sent out the following announcement under date of August 6 which is self explanatory:—

"Meeting in this city yesterday, our executive committee confirmed their vote already taken and approved by the board of directors that our usual Chicago convention scheduled for September 27-30 should be cancelled. This action was taken in recognition of the policy against large conventions announced by the Director of Defense Transportation on account of the pressure on travel facilities. It is announced, incidentally, that the Stevens Hotel was taken over by the Government this month.

"Your officers and directors keenly recognize the loss entailed to our members in missing opportunities for contacts, discussion and dissemination of information which the convention would afford. The executive committee has approved the policy of trying to make good this loss by the arrangement of a series of regional meetings in the late summer and early fall. These will be attended by members of the staff prepared to discuss current conditions and transmit all available information to the trade."

Expects Record Pulp Output

United States pulp production, which has set an unbroken succession of records beginning with 1939, now appears headed for a new all-time record in 1942, according to Ossian Anderson, president, Puget Sound Pulp and Timber Company.

Domestic output of all grades of wood pulp combined, amounting to 5,469,000 tons in the first six months of 1942, constituted a gain of 12.3% over output for the comparable months of 1941, Mr. Anderson stated. Output of all chemical grades, at 4,454,000 tons for the six months, was 13.8% ahead of last year; production of 1,015,000 tons of mechanical pulps represented a 6.1% increase.

"Most notable percentage gain in 1942 to date has been accomplished in the manufacture of unbleached sulphite pulp," Mr. Anderson declared. "Six months' output of 673,000 tons created an increase of 113,000 tons, of 21.3% over the comparable 1941 period.

"One year ago," Mr. Anderson recalled, "the threat of pulp shortage caused grave concern. Through the combined efforts of the American industry this threat has been removed.

Consolidated Paper Signs Agreement

Harry Sayre, president, United Paper Novelty and Toy Workers International Union, C. I. O., has given out the following statement:—

"A blanket labor agreement covering approximately 1700 employees of the Consolidated Paper Company became effective August 10. The agreement is between the company and the United Paper, Novelty and Toy Workers International Union, CIO, and covers employees in the Southern Division, Northern Division and No. 1 plants in Monroe, and the No. 10 plant in River Rouge. The new agreement was ratified by the employees affected at special meetings of the various locals last week.

"In general the new agreement follows previous agreements which it replaces. It includes the Union Shop, check-off of dues, vacations with pay, seniority, procedure for settling grievances and working conditions. It also includes a blanket wage increase of 5 cents per hour on all piece work and hourly wage rates. This wage increase will make a total of 25 cents per hour in general wage increases granted by the Consolidated Paper Company since January 1, 1941; approximately double what the increase in the cost of living has been since that date. Wages paid under the new contract will make the employees of the Consolidated Paper Company the highest paid in their branch of the paper industry. The average wages for all employees for the total number of hours worked, including overtime, will be substantially over $1.00 per hour; this compares favorably with the average in any industry. This wage increase means considerable to the City of Monroe also, as the Consolidated employees will have an additional $150,000 to expend in the various business institutions in the next 12 month period.

"The new contract includes a Christmas bonus based on company net profits. This is on a sliding scale and provides that if the company makes a substantial profit in 1942 that the bonus will be $50 for employees with the company one year or longer. This should be an incentive to the employees to avoid any unnecessary waste and expense to the company, because as the net profits decrease, so the bonus decreases.

"The most important departure from previous agreements was the substitution of the eight hour day and the forty hour week for the six hour day and the thirty-six hour week. Company representatives adequately covered the reasons for this change. They stated to Union representatives that the change was not because the six hour day was unsatisfactory because, under normal conditions, it has proven efficient; however, under war time conditions, because of the draft and the drain on labor caused by defense industries, it was impossible for the company to continue on the old basis. It was the opinion of both the company's and the union's representatives that the change was the patriotic thing to do, and in line with government policy, to free as much labor as possible for other defense industries more vital to the war effort. Incidentally, employees with seniority will all have employment in spite of the change. Union officials approved the change because the influx of new workers to replace those drafted and those who went to defense industries was working a terriffic hardship, because of lack of experience, on old employees. Adjustments will be made in hourly and piece rates of employees who received overtime pay on the basis of the 36 hour week so that no pay loss will result because of this change.

"The contract was negotiated by E. F. Fulkerson, Personnel Director, and C. Q. Baron, secretary, for the Consolidated Paper Company, Harry Sayre, International Representative for the International Union, Roderick Kent, Sill Owens and Lyle Curley for Local 1000, Scott Cole, Leo Navarre, and Frank Griffin for Local 1004, James Lindsey and Charles Wargai for Local 1001, and Herman Kralhnke and Fred Kipf for Local 1006."

S. Kipnis Calls Salvage Meeting

Samuel Kipnis, president of the National Container Corporation, Long Island City, N. Y., gave a luncheon-meeting at the Hotel Roosevelt, New York, on August 11.

Mr. Kipnis, chairman of the Industrial Salvage Committee of the WPB Conservation Division, for the Paper Box, Bag, Folding Box, Corrugated and Fiber Container Industries, explained that the Industrial Salvage Section of the War Production Board had requested him to call a meeting of the leading men in these branches of the paper industry. The objective of the meeting was the discussion of a plan for the conservation of scrap material.

Mr. Kipnis presided at the well attended meeting and explained that his committee planned to reach every concern located in Greater New York. This is a part of a nation-wide salvage drive, he said, to salvage from industrial plants essential materials for the war effort, such as iron and steel, non-ferrous metals, rubber, burlap and obsolete machinery.

The meeting was attended by representatives of 57 leading concerns. R. Merrill Decker, regional chief of the Industrial Salvage Section, discussed a plan which is being put into operation throughout the country. He emphasized the urgent need for all the scrap steel that could be collected and stated that in the production of one ton of finished steel one-third of it was composed of scrap. Mr. Decker also touched upon the serious supply situation in rubber, stating that the normal domestic consumption is 600,000 tons annually, 97% of which has been imported from the Far East. Current requirements, he said is estimated at 800,000 tons, with no imports available.

Mr. Kipnis announced that an executive committee would be appointed and that a meeting would be held on Thursday, August 15.

Hammermill Agents to Meet August 27-28

The thirty-first annual conference of the agents of the Hammermill Paper Company will be held Thursday and Friday, August 27 and 28, at the Kahkwa Club, Erie,. Pa. As in other years the recreational and social activities will be held in the afternoons and business conferences between representatives of the mill and Hammermill agents will be in the mornings.

Bagley & Sewall Assessment Increased

WATERTOWN, N. Y., August 10, 1942—An increase in the assessment valuation of several prominent industrial concerns is shown in the budget for next year. Among the highest is an increase of $64,000 for the Bagley & Sewall Company which is now assessed for $200,000. Previously the property was assessed for $136,000.

Indianapolis Demand Less Active

[FROM OUR REGULAR CORRESPONDENT]

INDIANAPOLIS, Ind., August 10, 1942 — No improvement in the general paper market was seen here during the last week; in fact, according to jobbers, there was a further slight decline in many items. Demand is a lot under what it was a year ago, due largely to the fact that the war effort is diverting much stock to government purposes.

Manufacturers, however, are working practically to capacity in this area. Demand is good, mostly for government consumption or for industries which are almost 100 percent defense. Paper board and box factories have been working steadily and have a backlog of orders which insure production for the remainder of the year.

Demand for kraft, wrapping paper and bags is fair, though not as high as it was a year ago. Following the campaign earlier in the year to conserve wrapping paper and bags, the retail stores in this section say that now although there is no apparent shortage, the general public still is bringing in baskets or what have you and taking their merchandise home without packaging.

A steady decline in demand for roofing paper and building paper continues here. The volume of building permits is just about half for the first half of this year that it was a year ago. Again the war effort is responsible. Even though this area is a highly defense area, building has sagged considerably. High priced houses and apartment buildings virtually are passe. There is some small house construction, but the volume is not high.

Tissues were moving well last week. Demand for summer specialties was low, even though weather was hot. Tire rationing has curtailed to a great degree, the week-end fishing trips and picnics and the summer specialty volume dropped in direct proportion.

No change was reported in the waste paper situation. Due to the relatively low prices being paid, collections have dropped off sharply. Local warehouses have ample stocks. No change was seen in the rag market with prices held fairly steady.

A. Sawyer & Co. Sold

RUTLAND, Vt., August 10, 1942—A Sawyer & Co., wholesalers of paper and woodware, have sold their stock and three-story brick building to the Norcross Eldridge company of North Adams, Mass., which will continue both establishments, Miles S. Sawyer of this city, president of the Sawyer company, said last week.

The transfer of the business will take place September 1. The Sawyer store has been under the same family name and in the same location since 1875. The Norcross firm comprises Ray Norcross, Earl M. Norcross and Frederick D. Norcross.

Celotex Shifts Plant to Suit Army

The Celotex Corporation has relinquished its plant in the Port Newark area to the Army and has taken a long lease on the property formerly occupied by the Royal Manufacturing Company at Lincoln, Middlesex County, N. J. The new quarters include a modern industrial building of about 35,000 square feet, with twelve acres of land, served by the Lehigh Valley Railroad.

W. J. Tilden Goes to Miami

GREAT LAKES, Ill., August 10, 1942—William J. Tilden, of 2404 North Deere Park Drive, Highland Park, Ill., former western manager of White Paper Divisions, has been named executive officer at the Naval Training School for radiomen, Miami University, Oxford, Ohio.

The new school, recently opened on the university campus, has accommodation for 600 students, chosen following a series of aptitude tests given them during the recruit training period. At the completion of their course of specialized training these men will be sent to sea for duty with the fleet or to one of the many Naval shore stations.

Lieut. Tilden has been prominent in the paper business since 1924. At various times he was associated with Halsey Stuart Company, Chicago; International Paper Company, New York; Eastern Manufacturing Company, Bangor, Me.; and the Meade Sales Company, Chicago. He received a degree in philosophy from the University of Chicago in 1925 and did post graduate work in chemistry at the University of Maine. The new executive officer is a former president of the Western Association of Delta Kappa Epsilon and is a member of the U. S. Naval Institute.

Newsprint Production Lower

Production of newsprint in Canada during July 1942 amounted to 241,178 tons and shipments to 243,620 tons, according to the News Print Service Bureau. Production in the United States was 76,952 tons and shipments 76,181 tons, making a total United States and Canadian newsprint production of 318,130 tons and shipments of 319,801 tons. During July, 20,106 tons of newsprint were made in Newfoundland, so that the North American production for the month amounted to 338,236 tons. Total production in July 1941 was 406,223 tons.

The Canadian mills produced 15,265 tons less in the first seven months of 1942 than in the first seven months of 1941, which was a decrease of eight tenths of one percent. The output in the United States was 40,462 tons or six and seven tenths percent less than in the first seven months of 1941, in Newfoundland production was 29,626 tons or fourteen and five tenths percent less, making a total decrease of 85,353 tons, or three and one tenth percent less than in the first seven months of 1941.

Stocks of newsprint paper at the end of July were 156,446 tons at Canadian mills and 17,820 tons at United States mills, making a combined total of 174,266 tons compared with 175,937 tons on June 30, 1942, and 169,768 tons at the end of July 1941.

"Keep 'Em Rolling"

An attractive booklet describing the highlights of its 25-minute motion picture, "Keep 'Em Rolling," showing the importance of rubber in the nation's war effort has just been published by The B. F. Goodrich Company, Akron, Ohio, and is now available upon request. The booklet contains three self-addressed request cards for the showing of the film, which may be obtained for showing before any organized group.

TURN IN ALL YOUR

SCRAP

It'll Shorten the War!

LET'S FACE THESE FACTS: Waste materials—scrap metals, rubber and all the rest—are the lifeblood of America's war industry, perhaps of *your own plant!* The demand is great, the supply dwindling. Before we can win, *every pound* of these idle materials must be converted into ships, tanks and guns. Remember this: About one-half ton of steel scrap is needed for every ton of new steel produced.

There may be forgotten tons of scrap in *your* plant. *Put these waste materials to work.* (Steel scrap collected will be purchased by the steel industry at the government-controlled price.)

HERE IS HOW YOU CAN HELP:

1. Name a wide-awake salvage committee chairman for each division and department of your plant. Set up a definite, *continuous* salvage program.

2. Inspect worn-out or obsolete equipment. If it can be used—fine! If not, why not scrap it?

3. Set a plant clean-up day for *every* week. (War machines never stop eating.) Collect everything that is not useful.

4. Separate the scrap — ferrous and non-ferrous metals, for example. Then call the scrap dealer.

5. On plant bulletin boards urge your employees to search their homes and garages for old rubber articles and discarded metal equipment. Then get it to a local Salvage Committee, charity, or junk dealer.

★ ★ ★

The reward is great: American lives saved, a shorter war and a quicker return to your peacetime work. Will you help? The American Rolling Mill Co., 2291 Curtis Street, Middletown, Ohio.

★ ★ ★ ARMCO ★ ★ ★

This advertisement is in support of the Salvage Program of the Bureau of Industrial Conservation, the War Production Board.

CONSTRUCTION NEWS

Under limitation order L-41 all projects involving expenditures of more than $5,000 must be specifically approved by the War Production Board. The status of projects reported herewith under the provisions of the order is not known.—EDITOR.

Escanaba, Mich.—The Escanaba Paper Company, manufacturer of book, newsprint and other paper stocks, has completed plans for new addition to mill at Groos, vicinity of Escanaba, and will proceed with erection at once.

Boston, Mass.—The Market Paper Box Company, 450 Western avenue, Brighton, Boston, manufacturer of stiff paper boxes, has plans nearing completion for new addition. It will be used for extensions in storage and distributing department. No estimate of cost announced. Erection is scheduled to begin at early date.

Paterson, N. J.—The Fiber Section of the War Production Board, Washington, D. C., is reported to have approved the construction of a pilot plant at Paterson for the production of bags and containers utilizing palmetto scrub as raw material. New plant will operate under a process perfected by C. H. Van der Jacht, a native of Puerto Rico. Raw material will be secured from Florida and other Southern States.

Salem, Ore.—The Oregon Pulp and Paper Company, manufacturer of bond and other writing paper stocks, greaseproof papers, etc., has begun erection of new one-story addition to mill, recently referred to in these columns, and expects to have the structure ready for service at early date. It will be used as a warehouse unit and is reported to cost approximately $25,000, including equipment. Viesko & Hannaman, Salem, have the general erection contract.

Chicago, Ill.—James Davis, Inc., 1400 North Milwaukee avenue, wall paper stocks, has approved plans for a new one-story building on local site at 1380 North Wolcott avenue, to be used for storage and distributing service. General contract for erection has been awarded to the Mutual Contracting Company, 2532 Warren boulevard, and work is scheduled to begin at once. E. A. Grunsfeld, Jr., 540 North Michigan avenue, is architect.

Chicago, Ill.—The Dixie-Vortex Company, 421 North Western avenue, manufacturer of paper cups, is operating on a capacity schedule, with full working force in all departments. It is expected to hold to this production basis for an indefinite period. Branch plant of company at Easton, Pa., similarly is on a maximum production schedule.

Los Angeles, Calif.—The Papier Mache Corporation, recently organized with capital of 100 shares of stock, no par value, plans operation of a local plant for the manufacture of paper and papier mache specialties. Incorporators of new company include N. Nesbitt and Z. L. Zacche. Company is represented by Ben L. Blue, 315 West 7th street, Los Angeles, attorney.

Detroit, Mich.—The Detroit Sulphite Pulp and Paper Company, 9125 West Jefferson street, manufacturer of wrapping, tissue and other paper stocks, has completed plans for new steam power plant at mill, and will proceed with construction at early date. General erection contract has been awarded to the W. J. C. Kaufmann Company, 10610 Shoemaker street, Detroit.

Kalamazoo, Mich.—The Therminsul Corporation, 1603 Fulford street, manufacturer of sheet insulation products, has taken out a permit to make alterations and improvements in mill. Work will be carried out at once. No estimate of cost made.

New York, N. Y.—The Arkell Safety Bag Company, 10 East 40th street, manufacturer of paper linings for barrels, drums and other containers, has perfected a new type of crinkled paper, which can be stretched in any direction, rather than in one way only, as ordinarily the case. The paper is designed for heavy-duty service in baling and other forms of wrapping, and is capable of withstanding severe strain and shock without breakage. The new stock is moisture-proof. Company will carry out extensive production of the paper at its local plant.

New York, N. Y.— The Ruberoid Company, 500 Fifth avenue, New York, manufacturer of roofing and insulation papers, and other stocks, is maintaining capacity production at its 11 mills in different parts of the country, with large part of current output, ranging from 75 to 95 per cent at the different plants, being diverted for Government service. It is expected to hold to a maximum production basis for an indefinite period. Company has arranged for lease of space in the Bell Building, 307 North Michigan avenue, Chicago, Ill., and will remove its Western division offices from 5333 South Western avenue, Chicago, to new location on September 1.

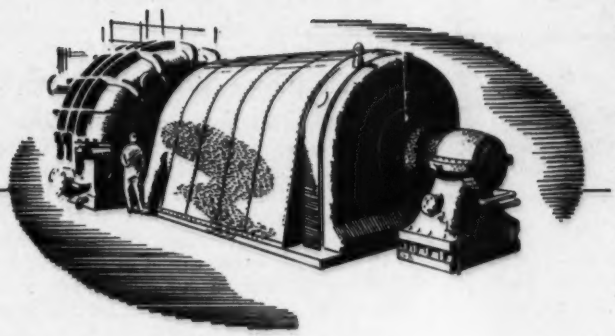
Reidsville, N. C.—The Chase Bag Company, 309 West Jackson boulevard, Chicago, Ill., manufacturer of paper bags and contalners, multi-wall and other bags, has arranged for lease of the William Carter Building at Morehead and Harris streets, Reidsvills, for a long term of years, and will occupy for its local factory branch and converting plant. All machinery and equipment will be transferred from building on East Market street, heretofore occupied by company, to new location at early date, where increased production facilities will be provided.

New La Motte Micro pH Testing Set

A new set with facilities, it is said, never before offered in the colorimetric system for pH determinations has been announced by the LaMotte Chemical Products Company of Towson, Baltimore, Maryland.

It is interesting to note that it requires less than 0.5 ml. of the sample to make the determination and the accuracy of the test is plus or minus 0.1 of a pH. Another feature is that turbidity and color in the sample does not interfere with the pH determination and the actual determination can be made in one minute or less.

The standard set covers the pH range of 5.2 and 8.6 and is available in a compact case which includes all the necessary glassware, indicators and full instructions for making the test.



OPERATING data covering major turbine installations throughout the country are verifying daily the fact that Gulfcrest Oil gives unmatched performance in steam turbine lubrication. Here's the important reason:

Gulfcrest Oil is not only refined from the best selected crude oils produced in the United States, but is super-refined by the exclusive Gulf Alchlor Process, the most effective method yet known for removing undesirable constitutents from oils.

The most grueling tests—both in the laboratory and in actual service — have proved that the unequaled refining power of the Alchlor Process produces an oil which forms less gum and other harmful deposits, and less emulsion and sludge than any other turbine oil of which we have record.

Write today for the story of Gulfcrest Oil and what it can do for you—no obligation, of course.

The Finest Crude Oil

plus

Modern Refining

plus

the Alchlor Process

=

GULFCREST OIL

The world's finest oil for turbine lubrication

4 REASONS why Gulfcrest Oil is the Turbine Lubricant of Unparalleled Quality

1. REFINED BY THE ALCHLOR PROCESS. The most thorough and effective method for removing chemically active hydrocarbons as well as the general run of impurities present in all crudes.

2. HIGHEST RESISTANCE TO OXIDATION. Because this famous ALCHLOR Process synthesizes and rearranges the molecular structure of certain hydrocarbons, resulting in a finished product of greater stability, GULFCREST OIL stands alone in its high resistance to oxidation.

3. HIGHEST RESISTANCE TO ACIDITY AND SLUDGE. Because of the elimination of oxidation catalysts in addition to the unparalleled refining power of the Alchlor Process, these oils form less gum and deposits, less emulsion and sludge, when mixed with water over a period of several years continuous operation, than any other turbine oil of which we have record.

4. HIGHEST KILOWATT-HOUR PERFORMANCE. Because Alchlor not only makes possible an oil more thoroughly refined and homogeneous, but also creates anti-oxidants, these oils have great resistance to deteriorating influences and are longer lived. Less make-up oil is required.

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company PTJ
3800 Gulf Building, Pittsburgh, Pa.

Please send me my copy—no charge—of the brochure "Gulfcrest Turbine Oil."

Name _____

Company _____

Address _____

FINANCIAL NEWS

New York Stock Exchange

High, Low and Last for Week Ending August 8, 1942

STOCKS

	High	Low	Last
A. P. W.	1½	1⅜	1⅜
Armstrong Cork Co.	26¾	25¼	25¾
Celotex Corp.	6¾	6¼	6¾
Celotex Corp., pf.	70	70	70
Certain-Teed Products Corp.	2	1¾	1¾
Certain-Teed Products Corp., pf.	26¼	25	25
Champion Paper & Fibre Co.	....	....	....
Champion Paper & Fibre Co., pf.	94½	93⅜	94½
Congoleum Nairn Co.	15½	15⅛	15⅛
Container Corp. of America	12⅜	12¼	12¼
Continental-Diamond Fibre Co.	6⅜	6¼	6¼
Crown-Zellerbach Co.	10¾	10⅜	10⅜
Crown-Zellerbach Co., pf.	81	81	81
Dixie-Vortex Co.	8⅞	8¾	8¾
Dixie-Vortex Co.—A.	35½	35	35½
Flintkote Co.	11¼	10⅞	10⅞
Robert Gair	1½	1½	1½
Robert Gair, pf.	9⅜	9⅜	9⅜
International Paper Co.	9¼	8¾	9
International Paper Co., pf.	49	47½	47½
Johns-Manville Corp.	57	55¾	55¾
Johns-Manville Corp., pf.	....	....	....
Kimberly Clark Corp.	25¾	25¾	25¾
MacAndrews & Forbes	....	....	....
MacAndrews & Forbes, pf.	126	126	126
Masonite Corp.	26¼	26¼	26½
Mead Corp.	6⅜	6¼	6½
Mead Corp., pf.	66½	65	66½
Paraffine Companies, Inc.	28½	28½	28½
Paraffine Companies, Inc., pf.	....	....	....
Rayonier, Inc.	9¼	9⅛	9¼
Rayonier, Inc., pf.	24½	24½	24½
Ruberoid Co.	17½	17⅛	17⅛
Scott Paper Co.	32¼	31⅞	32¼
Scott Paper Co., pf.	113	112	112
Sutherland Paper Co.	21¾	21½	21½
Union Bag & Paper Corp.	8⅝	8⅜	8⅜
United Paperboard Co.	3¼	3⅛	3⅛
U. S. Gypsum Co.	54	52½	53¼
U. S. Gypsum Co., pf.	170	170	170
West Virginia Pulp & Paper Co.	....	....	....

BONDS

Abitibi Pulp & Paper Co. 5s '53	69½	69½	69½
Celotex Corp. 4½s '47	98¾	98½	98½
Certain-Teed Products Corp. 5½s '48	90	88⅝	89½
Champion Paper & Fibre Co. 4¾s '50	104¾	104½	104½
Champion Paper & Fibre Co. 4¾s '50	103¾	103¾	103¾
International Paper Co. 6s '55	105	104¾	104¾
International Paper Co. 5s '47	104½	104½	104½
Mead Corp. 4½s '55	....	....	....
West Virginia Pulp & Paper Co. 3s '54	105	104⅞	104⅞

New York Curb Exchange

High, Low and Last for Week Ending August 8, 1942

STOCKS

	High	Low	Last
American Box Board Co.	4¼	3⅞	3⅞
Brown Co., pf.	....	....	....
Great Northern Paper Co.	29	28½	28½
Hummel-Ross Fibre Corp.	2¾	2¾	2¾
National Container Corp.	....	....	....
St. Regis Paper Co.	1⅝	1½	1½
St. Regis Paper Co., pf.	110	110	110
Taggart Corp.	2⅞	2⅞	2⅞

BONDS

American Writing Paper Co. 6s '61	83	82	82

Dennison Profits Off

The Dennison Manufacturing Company and wholly owned subsidiaries for the six months to June 30, reports consolidated net earnings, after $655,000 taxes, at an estimated $234,000, compared with $319,000 after $590,000 tax provision, last year; consolidated sales, $8,398,000 increased from $6,512,000.

Albermarle Nets $6.21

The Albermarle Paper Manufacturing Company for the June quarter, reports a net income of $74,728, equal to $6.21 a share, on 9,500 shares, of common stock.

Flintkote Earnings Down

The Flintkote Company and subsidiaries for the sixteen weeks to July 18, reports a net profit of $384,841, equal, after dividend requirements on $4.50 preferred stock, to 46 cents each on 713,706 common shares, against $710,477, or $1 a share on 686,196 common shares, for sixteen weeks to July 12, 1941. Twenty-eight weeks to July 18: Net profit, $691,331, or 83 cents a common share, against $1,016,264, or $1.45 a common share, for twenty-eight weeks to July 12, 1941. Fifty-two weeks to July 18: Net profit, $1,412,728, or $1.78 a share on common, compared with $1,831,344, or $2.64 a common share, for fifty-two weeks to July 12, 1941.

Gaylord Earns Less

The Gaylord Container Corporation and subsidiary for the June quarter, report a net profit of $270,378, equal after preferred dividend requirements to 37 cents each on 539,221 common shares, against $273,133, or 38 cents a share in March quarter and $394,201, or 60 cents a share in June quarter a year ago. Six months: Net profit, $543,511, or 75 cents a common share, against $608,039, or 86 cents a share on common, last year.

Certain-teed Earns $6.27

The Certain-teed Products Corporation and wholly owned subsidiaries for the six months to June 30, reports a profit after $815,459 Federal income and Canadian income taxes, of $458,609, equal to $6.27 a share on 6 per cent preferred stock in arrears. Net profit for 1941 period, after $316,986 provision for income taxes, was $507,623, or $6.95 a share on 6% preferred.

American Box Board Profits Up

The American Box Board Company for the twenty-four weeks to May 16, reports a net income of $158,933, equal after preferred dividends, to $1.01 each on 121,363 common shares, against $107,226, or 58 cents a common share for twenty-four weeks to May 17, 1941; net sales, $2,126,053, against $1,532,730.

Scott Co. Nets $1.06

The consolidated report of the Scott Paper Company, disclosed that net sales for the six months ended on July 4 were $17,235,788, an increase of 45% over $11,846,072 sales for corresponding period of 1941.

After provision for preferred dividends, the net earnings are equal to $1.06 a share on the common stock, against $1.11 last year.

Continental-Diamond Nets 50 Cents

The Continental-Diamond Fibre Company and wholly owned domestic subsidiaries for the six months to June 30, reports net profit, after $855,500

provision for Federal income and excess profits taxes and $50,000 for contingencies of $228,088, equal to 50 cents a share. Adjusted net profit for 1941 period, after providing $588,000 for Federal taxes and $50,000 for contingencies, was $345,685, or 77 cents a share.

U. S. Envelope Nets $6.96

The U. S. Envelope Company reports for the six months ended June 30, 1942, an estimated net profit of $322,013, after depreciation and taxes, equal, after preferred dividend, to $6.96 a common share. Estimated earnings for the first half of 1941 were $248,788. Sales for the six months were 22% above 1941 week. Stock inventories were about $359,000 higher on June 30, 1942, than on December 31, 1941.

Lily-Tulip Cup Nets $3.98

The Lily-Tulip Cup Corporation and subsidaries for the twelve months to June 30 reports an estimated net profit of $754,802, after $1,194,638 provision for Federal income and excess profits taxes and an additional $173,153 for taxes. Profit is equal to $3.98 each on 189,539 common shares and compares with net of $607,220, or $3.20 a share, for twelve months to June 30, 1941, when provision for Federal income and excess profits taxes totaled $456,351.

Mead Corp. Profits Up

The Mead Corporation and subsidiaries for the twenty-four weeks to June 13, reports a net profit of $867,168, equal, after preferred dividend requirements, to $1.07 each on 625,000 common shares, against $766,358, or 89 cents a common share in 1941 period. Twelve weeks to June 13: Net profit, $381,115, or 45 cents a common share, against $486,053, or 62 cents a common share for twelve weeks to March 21, 1942, and $404,321, or 48 cents a share on common for similar weeks of 1941.

Sutherland Profits Lower

The Sutherland Paper Company for the six months to June 30, reports a net profit after excess profits taxes and $100,000 reserve for contingencies, of $349,054, equal to $1.21 each on 287,000 common shares, against $426,707 or $1.48 a share last year. Profit before Federal taxes amounted to $1,163,514 compared with $609,582 for first half of 1941.

Consolidate Power Loses

The Consolidated Water Power Company of Wisconsin Rapids, Wis., an affiliate of the Consolidated Water Power and Paper Company, reports net earnings for the first six months of 1942 at $626,663. This compares with $824,979 for the corresponding period in 1941.

Women Join Red Cross

Twenty women employees of the Kimberly-Clark Corporation at Neenah, Wis., have been enrolled for Red Cross first aid courses. The classes will meet weekly until twenty hours have been completed, after which American Red Cross certificates will be awarded.

Every Paper Production Man should have

THIS NEW MOYNO PUMP BOOK!

Get Yours—and Read How to Solve Your TOUGH Pumping Problems!

IF YOU'RE looking for a new, *different* type of pump that can do the job better and faster—with less maintenance and fewer pumping-trouble delays—send for this free book *now!*

It's a *brand new* 8-page book, packed with practical information on the R & M Moyno Pump. Facts that show how its ability to handle stock, size and coating can revolutionize pumping operations in *your* plant. It tells how the Moyno compares in *principle* with other types of pumps. How it is helping paper and other vital industries to produce more—and improve product quality at the same time. How the Moyno has proved—feature by feature—to be the greatest pumping improvement in decades!

The entire book was written by R & M Moyno engineers who have spent many years solving *tough* paper pumping problems. If you don't need it for immediate reference, you'll want it later. It's yours free—mail the coupon today!

ONLY 1 MOVING PART!

Here's the patented principle of the R & M Moyno Pump's amazing performance. A single-threaded helical rotor revolves in a double-threaded helical stator, providing pumping action like that of a piston moving through a cylinder of infinite length.

Moyno pumps are manufactured under R. Moineau's patents

ROBBINS & MYERS, Inc., Moyno Pump Division, Springfield, Ohio

Please send me the new 8-page book on the R & M Moyno Pump.

Name .....

Firm Name .....

Address .....

Pump will handle .....

PAPER TRADE JOURNAL

Title Reg. U. S. Pat. Off.

Henry J. Berger
EDITOR

Vol. 115 August 13, 1942 No. 7

COMING EVENTS IN PAPER INDUSTRY

New England Section. Technical Association of the Pulp and Paper Industry—Third Friday of each month at the Roger Smith Hotel, Holyoke, Mass.

Delaware Valley Section. Technical Association of the Pulp and Paper Industry—First Friday of each month at the Engineers Club, Philadelphia, Pa.

Lake States Section. Technical Association of the Pulp and Paper Industry—Second Tuesday of each month at the Conway Hotel, Appleton, Wis.

Kalamazoo Valley Section. Technical Association of the Pulp and Paper Industry—First Thursday of each month at the Park, American Hotel, Kalamazoo, Mich.

Technical Association of the Pulp and Paper Industry. Fall Meeting, Statler Hotel, Boston, Mass., September 29-October 1.

WAGES AND LIVING COSTS

The action of the National War Labor Board in granting a wage increase to the employees of the four so-called "Little Steel" companies represents a major defeat in the struggle for enforcement of the Government's program of price control, states the Guaranty Trust Company of New York in discussing the position of labor in the war effort in the current issue of *The Guaranty Survey*, published July 27. "Although the amount of the increase is less than half of that demanded by the union, the board's decision, taken in the face of the admitted fact that steel wages were already considerably higher than the average in manufacturing industries, tends strongly to confirm the view that administrative action alone is not sufficient to check the upward wage-price spiral," *The Survey* continues.

Expressing the opinion that the decision has made the wage and price problem more complicated and acute, *The Survey* points out that, "The defeat suffered by the President's stabilization program in this case leaves little hope for effective price regulation under the present set-up. The Government now apparently faces the difficult alternative of abandoning all serious effort at price stabilization or resorting to more drastic methods of wage control. The whole situation illustrates the difficulty with which a large and loosely organized nation adapts itself quickly to the stern necessities of an emergency such as we are now facing. There is no doubt as to the fundamental patriotism of the vast majority in the ranks of labor, as well as of management. The great danger lies not in lack of patriotism but in lack of appreciation of the gravity of our position and of the tremendous magnitude of the task that has been thrust upon us. The requirements of that task leave no room for the easy optimism with which too many of the American people still regard the outlook. The cost of victory will be very high, and it must be shared by every individual and every group."

In advocating closer wage control, *The Survey* goes on to say that, "These conditions emphasize the potency of the forces that are operating to exert an upward pressure on the wage level and cast strong doubt on the possibility of achieving even a reasonable degree of price stability without some form of direct and enforcable control over rates of pay. This doubt has become almost a certainty with the failure of present voluntary methods of regulation to meet the critical test provided by the wage dispute in the steel industry. The test was critical for two main reasons. First, the fact-finding panel of the War Labor Board recognized that both weekly and hourly wage rates in the steel industry were substantially higher than comparable rates in the manufacturing industries as a whole, so that by no stretch of the imagination could steel wages be deemed to require adjustment on the ground that they were below the general level. Second, it is a well-known fact that wages in the steel industry are widely regarded as constituting a sort of standard by which rates of pay in other industries tend to be measured, and that, as one of the steel companies has pointed out, increases in steel wages in the past have 'spread like wildfire' through other industries."

Continuing its analysis of the wage decision of the War Labor Board, *The Survey* says in part that, "The board based its decision on the view that the cost of living advanced 15% from the beginning of 1941 to May, 1942, while wages received by the workers rose only 11.8% during the same interval, so that a further increase in wages was required to re-establish the 'peace-time standard' of real wages or purchasing power. It is axiomatic, however, that peace-time standards for selected groups can be achieved only by increasing the sacrifices imposed on other groups. Since wage-earners and their dependents constitute a majority of the population, the rule laid down by the board is clearly impracticable as a general method of regulating incomes in such a way as to contribute to price stability. The slowness with which the critical nature of the wage issue has gained general recognition is probably due in part to the persistent belief that wage increases are primarily results, not causes, of higher prices. While this view may hold true in some cases, it is difficult to find support for it in the developments of recent years. Not only since the precent war started, but even since the beginning of the last one, wages have risen much more rapidly than the cost of living. Average weekly earnings in ninety industries have advanced 48% and average hours earnings 28% since the start of this war in September, 1939, according to the Department of Labor, while the cost of living

has risen only 14% during this three-year period, From July, 1914, to the beginning of the present war, weekly earnings advanced 115% and the cost of living 40%."

In commenting on the forty-hour week, *The Survey* declares that, "It is widely recognized that, under present conditions, the forty-hour week is not primarily a limitatiion on hours but a minimum wage measure. While maintaining the forty-hour limit by law, the Government is, at the same time, urging maximum use of industrial facilities and man power. The result is that the number of hours worked in war industries is generally well in excess of forty a week but that payment of overtime rates is required by law. Available reports indicate that while, the forty-hour rule does not limit work to forty hours, it has a restraining influence on overtime employment."

S. F. Bowser & Co. Get Army-Navy E

On July 22, S. F. Bowser & Co., Inc., of Fort Wayne, Ind., and their wholly owned subsidiary, the Fostoria Screw Company of Fostoria, Ohio, were notified that they had been accorded the joint Army-Navy "E" Production Award.

"Naturally, we are very proud of this award," the company states, "because it is not easily won. In the words of the Under-Secretary of the Navy: 'This symbol is awarded only to those plants which are exceeding all production expectation in view of the facilities at their command'."

S. F. Bowser & Company, Inc., operate plants in Fort Wayne, Ind., and Alhambra, Cal.—as well as their subsidiary, the Fostoria Screw Company, with two plants in Fostoria, Ohio.

Production Ratio Report*

(Production as per cent of six-day capacity)

COMPARATIVE WEEKLY SUMMARIES

Current Weeks—1942		Corresponding Weeks—1941	
June 27	84.5	June 28	101.5
July 4...(Holiday Week)	71.4	July 5	72.8
July 11	67.2	July 12	95.2
July 18	81.7	July 19	100.7
July 25	80.2	July 26	101.9
Aug. 1.....(Preliminary)	79.8	Aug. 2	100.5

COMPARATIVE MONTHLY SUMMARIES

Year	Jan.	Feb.	Mar.	Apr.	May	June	July
1941	85.6	89.7	92.2	96.0	98.7	99.3	94.2
1942	104.5	103.9	102.9	100.3	95.4	87.3	*75.2*

Year	Aug.	Sept.	Oct.	Nov.	Dec.	Year Avg.
1941	101.0	99.7	105.2	106.2	100.4	97.4
1942	....	....	....	....	....	....

COMPARATIVE YEARLY SUMMARIES

	1935	1936	1937	1938	1939	1940	1941	1942
Year to Date..	68.2	77.8	87.8	67.9	78.6	86.9	93.6	*95.4*
Year Average..	69.9	80.4	79.8	71.5	83.4	85.6	97.4	...

PAPERBOARD OPERATING RATIOS†

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year Avg.
1937	83	89	89	91	88	80	69	77	72	70	57	47	75
1938	56	63	63	60	60	59	59	69	70	73	67	61	64
1939	65	73	76	74	69	73	68	77	82	91	88	77	77
1940	78	75	74	76	82	85	77	79	78	85	82	77	78
1941	81	88	89	89	91	94	92	98	94	99	98	90	92
1942	102	101	101	95	82	72	68	..	..	..	..	..	..

Week ending June 27, 1942—72
Week ending July 4, 1942—59
Week ending July 11, 1942—52
Week ending July 18, 1942—71
Week ending July 25, 1942—74
Week ending Aug. 1, 1942—76

* Based on tonnage reported to American Paper and Pulp Association. Does not include mills reporting to National Paperboard Association, except in isolated cases where both paper and paperboard are produced and separate tonnage figures are not readily available. Does not include mills producing newsprint exclusively.

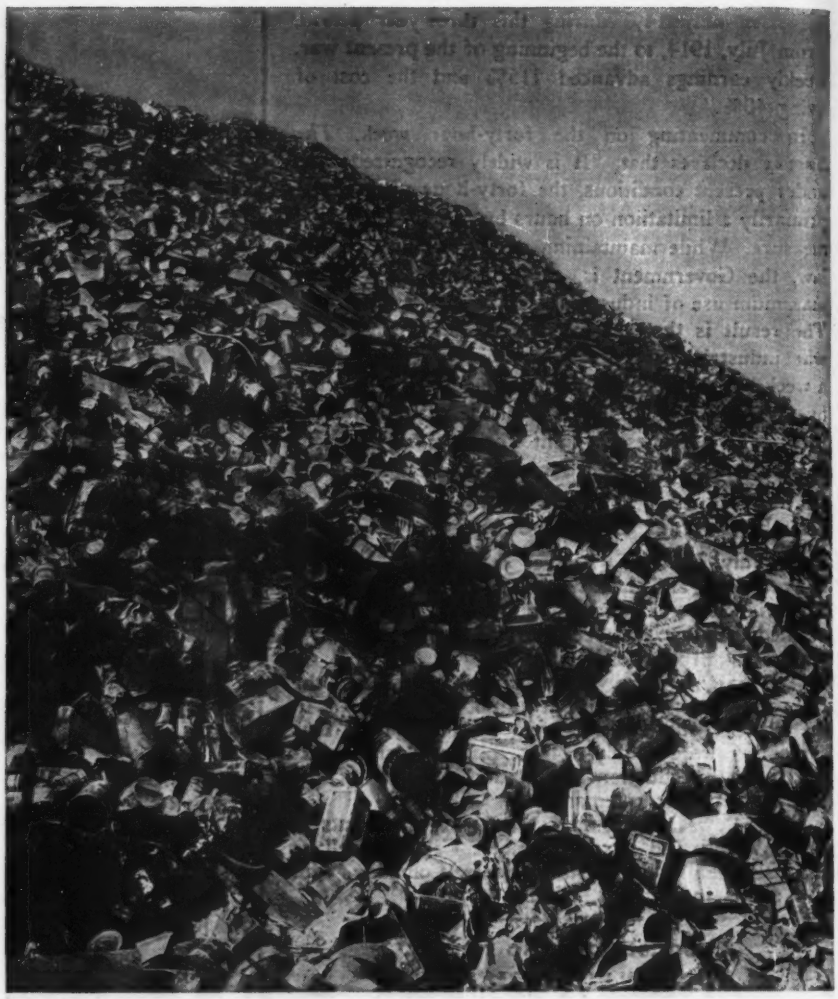
† Per cents of operation based on "Inch-Hours" reported to the National Paperboard Assn.

EXPORTERS
OF AMERICAN PULP

TO
BRITAIN
SOUTH AMERICA
AND ALL WORLD MARKETS

LYDDON
& COMPANY
(AMERICA) INC.

51 EAST 42ND STREET
NEW YORK CITY



CAUSTIC KEEPS 'EM SCRAPPING . . .

The more tin we recover from the nation's scrap piles, the more trouble there is in store for Hitler and Hirohito. • The recovery of tin from scrap is a big and important job; it is a job that calls for the concerted efforts of the American people to get in the scrap, and it calls for caustic soda to get the tin *out* of the scrap. • This is only one of the many wartime uses for caustic soda. This vital chemical product is helping to produce aluminum, rayon, soap and glycerin, to refine petroleum products and to reclaim rubber from old tires. • Michigan Alkali Caustic Soda, along with many other Michigan Alkali products, is helping the nation in wartime as it has done through many years of peace.

MICHIGAN ALKALI COMPANY

FORD BUILDING • DETROIT, MICHIGAN

NEW YORK • CHICAGO • CINCINNATI • ST. LOUIS • CHARLOTTE • WYANDOTTE

DISTRIBUTORS IN ALL PRINCIPAL CITIES

SODA ASH • CAUSTIC SODA • CHLORINE • BICARBONATE OF SODA • CALCIUM CARBONATE • CALCIUM CHLORIDE • DRY ICE

Section of the
Technical Association of the Pulp and Paper Industry

Edited by Ronald G. Macdonald, Secretary

Sequence in Multistage Bleaching of Kraft*

By Sidney D. Wells[1] and Frederick B. Schelhorn[2]

Abstract

A study has been made of the multistage process of Sunesson [U. S. patent 2,140,863 (Dec. 20, 1938)], in which unbleached kraft pulp is treated with calcium hypochlorite, washed, chlorinated, extracted with caustic soda, washed, treated with calcium hypochlorite, and finally thoroughly washed. This process causes severe degradation of the pulp, the principal source being the second-stage chlorination.

Chlorination following chlorine treatment is much more degrading to the cellulose than chlorination following hypochlorite when comparable amounts are used in each stage; the latter is much more degrading than hypochlorite following chlorination. Increased concentrations of chlorine have no beneficial effects. The degradation caused by increased concentration of hypochlorite in the first stage at increased pulp consistencies more than offsets any reduction in degradation by the decrease in the time required for the completion of the reaction. In the second-stage chlorination, the rates of consumption of chlorine and the degradation of the cellulose are closely parallel. In first-stage chlorination, the rate of chlorine consumption during the first ten minutes is relatively much greater than the rate of degradation of the cellulose. After 60 minutes, the rates are approximately parallel. It is therefore possible to choose an amount of chlorination in the first stage for a kraft pulp that will permit the required degree of bleaching with minimum over-all reduction in viscosity.

Introduction

In any multistage process the matter of sequence is important and, the more stages in the process, the greater the possible variation in the sequence of stages. In the majority of cases the manufacturing units engaged in the bleaching of kraft, to what is considered a bleached pulp of high brightness, employ a first stage which consists of chlorination, using from 40 to 60% of the chlorine demand of the unbleached pulp as chlorine in aqueous solution. This stage is usually followed by washing with water on an acid-proof vacuum filter. The pulp is then treated with caustic soda to dissolve the chlorinated lignin, and again washed on a vacuum filter or series of deckers. The washed pulp is then bleached with about two thirds of the remaining chlorine demand in the form of calcium hypochlorite, and maintained alkaline to phenolphthalein by means of the addition of caustic soda solution as often and in as great amounts, as is necessary. From ten pounds to forty pounds of caustic soda per ton of pulp is usually sufficient. The pulp is then washed on vacuum filters or multiple deckers, and subjected to a third bleaching with calcium hypochlorite, using about half of the amount used in the preceding stage. After 85 to 95% of the bleach is exhausted, the pulp is generally washed and sometimes treated with sulphurous acid in the final wash water to stabilize the color and accelerate the removal of bleach residuals. The procedure outlined above may be departed from in minor details in some cases but, in general, it is quite closely followed in the commercial bleaching of kraft pulp at the present time. The major considerations were thought *(22)* to be the chlorination of the unbleached pulp under decidedly acid conditions, the removal of the chlorinated lignin, and the bleaching of the resultant pulps with calcium hypochlorite under distinctly alkaline conditions throughout the bleaching operation. The observations leading to this belief were made by a great many investigators in the period between 1920 and 1935 *(1-23)*.

In spite of tacit agreement through general adoption, a patent issued to Sunesson in 1938 *(19)* showed that a different sequence was considered worthy of patent protection by at least one well-known manufacturer in Sweden. The procedure suggested therein was to subject unbleached kraft pulp to a treatment with calcium hypochlorite as the first stage, followed (after washing) by a treatment with chlorine, a wash, an extraction with caustic soda solution, a wash, a treatment with calcium hypochlorite, and finally a thorough washing. An investigation was consequently undertaken in which the relative merits of both the proposed, and the more generally accepted procedures were studied.

Experimental Methods

During the course of the experimentation stock densities employed varied from 3-25%. It was imperative that, in all cases, thorough mixing of the pulp and chemical be obtained. Consequently, devices were employed which best suited the particular consistency.

* Presented at the Annual Meeting of the Technical Association of the Pulp and Paper Industry, Hotel Commodore, New York, N. Y., Feb. 16-19, 1942.

A portion of a thesis submitted by the junior author in partial fulfillment of the requirements of The Institute of Paper Chemistry for the degree of Master of Science from Lawrence College, Appleton, Wis., June, 1941.

[1] Member TAPPI; Research Associate, The Institute of Paper Chemistry, Appleton, Wis.

[2] Graduate Student, The Institute of Paper Chemistry, Appleton, Wis.

Low Consistency—3%

In this case the pulp suspension was placed in a glass battery jar; agitation was induced by means of a double paddle of stainless steel which was driven by an electric motor. The arrangement is shown in Fig. 1. Since the speed of the motor could be controlled by the use of the variable resistance, it was possible to obtain a slow, but continuous motion of the stock upward along the shaft of the paddle and down around the periphery of the jar. Visual observation of the stock through the glass container permitted the detection of any dead spots which were eliminated by proper location of the paddle. For a short period before and after the addition of any reagents, the motor was speeded up to secure rapid stock agitation. This precaution was taken to insure rapid and even distribution of the chemical added.

High Density—10-15%

Experiments requiring a higher stock consistency were carried out in a Hobart mixer which was found to give complete mixing. The action of this apparatus produced small nodules of pulp which were easily penetrated by the reagent.

Reagents

A bleach liquor of calcium hypochlorite was prepared by trituration of dry bleaching powder with a suitable quantity of water. During hypochlorite treatments, the reaction medium was maintained slightly alkaline by the addition of suitable quantities of aqueous sodium hydroxide solution.

Chlorine was introduced as chlorine water which was prepared by passing the gas through a diffuser into cold water. In one case chlorination was carried out at 25% consistency. The pulp had previously been broken up in the Hobart mixer and was then placed in a large bottle closed by a paraffined rubber stopper. Gaseous chlorine was introduced at the bottom of the jar from a small tared chlorine cylinder. An exit tube was affixed which led into a solution of potassium iodide and starch. The arrangement is shown in Fig. 2.

A quantitative determination of the escaped chlorine was made by titration with standard thiosulphate solution. The decrease in weight of the chlorine cylinder minus the escaped chlorine gave an accurate measure of the chlorine taken up by the pulp. The bottle was frequently shaken during the operation.

In all cases the stock was washed with water and subjected to a 2% alkaline extraction for one hour, after which it was thoroughly washed.

Analytical Methods

a. Available chlorine in hypochlorite bleach liquor —TAPPI T 611 m-33

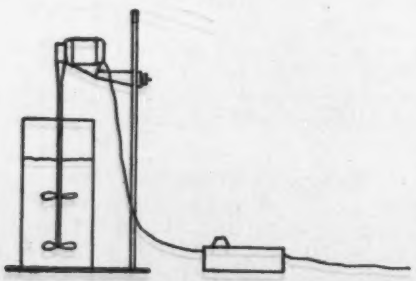


Fig. 1
Agitation Apparatus for Hypochlorite Bleaching

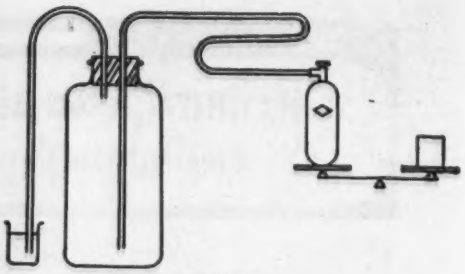


Fig. 2
Chlorination Apparatus

b. Permanganate number—TAPPI T 214 m-37
c. Cuprammonium viscosity—TAPPI T 206 m-37

Experimental Work

Unbleached Pulp

The pulp used throughout the experimental work was a jack pine kraft which had been cooked to produce a moderately easy-bleaching pulp and was stored in wet laps (about 30% moisture-free basis). The permanganate number and cuprammonium viscosity of the pulp were as follows:

Permanganate number	19.1
Cuprammonium viscosity	67.6

Physical evaluation of the pulp used was carried out in the pebble mill, both at the start and near the conclusion of the experimental work. The determination of the freeness development, burst factor, and tear factor checked closely, so that it may be concluded that no alteration of the pulp characteristics was induced by storage.

Preliminary Bleach

In the first experiment, the conditions cited by Sunesson *(19)* were followed. The data for the bleach were as follows:

1st Stage—5% available chlorine as hypochlorite at 20 deg. C.
2nd Stage—3% available chlorine as chlorine at 20 deg. C., followed by a caustic extraction.
3rd Stage—1.5% available chlorine as hypochlorite at 30 deg. C.

The chemical consumption in the first stage was rapid and was completed in 20 minutes. The chlorination was slow, however, and required about four hours for exhaustion. The final brightness was 76.5 (General Electric brightness tester).

Strength tests were made on samples of pulp taken at the completion of each of the above stages, and the results at the representative freeness of 550 seconds (Schopper-Riegler) are given in Table I.

TABLE I.—STRENGTH TESTS AT FREENESS 550 S.-R.

	Pebble Mill Revolutions	Bursting Factor	Tearing Factor
Unbleached Pulp	11100	150	1.40
After 1st stage, hypochlorite	10950	146	1.40
After 2nd stage, chlorination	10770	138	1.30
After 3rd stage, caustic extraction	7920	135	1.30
After 4th stage, alkaline hypochlorite	6840	130	1.25

The small loss in strength produced by the first-stage hypochlorite treatment was to be expected because of the similarity of this treatment to the semi-bleaching of kraft pulps for envelope paper and gummed tape, in which the papers obtained are usually slightly stronger than those made from unbleached pulp. The loss on chlorination, however, was not foreseen, neither was the time required for exhaustion of the chlorine, which was found to be four hours.

TABLE II.—CHEMICAL PROPORTIONING BETWEEN STAGES

Bleach Experiment	4	5	6	7	8
1st Stage—Consistency 3%; temperature 20° C.					
Chemical added, %....	5*	5**	3**	7**	5*
Permanganate number..	8.63	8.71	11.74	6.53	8.93
Cuam viscosity, cp.....	66.7	57.4	66.4	30.5	66.8
Time of bleach, min....	65	85	20	305	60
Final brightness, %...	27.4	42.9	32	56	26
2nd Stage—Consistency 3%; temperature 25° C.					
Chemical added, %....	3*	3*	5*	1*	3**
Permanganate number..	4.38	3.58	3.85	4.26	2.11
Cuam viscosity, cp.....	18.60	30.9	10.3	16.3	37.8
Time of bleach, min....	180	180	310	335	670
Final brightness, %....	39.5	52.1	46.7	59.6	69.8
3rd Stage—Consistency 5%; temperature 30° C					
Chemical added, %....	2.2**	1.2**	0.9**	2.8**	0.9**
Permanganate number..	2.24	2.28	2.27	2.59	1.76
Cuam viscosity, cp.....	11.2	19.9	10.4	8.69	24.0
Time of bleach, min....	525	495	250	520	665
Final brightness, %....	77.9	76.4	75.2	76.4	76.8
Total chemical consumption, %.....	10.2	9.2	8.9	10.8	8.9

* Chlorine.

** Hypochlorite.

Cuprammonium (Cuam) voscosity of unbleached pulp, 67.6 centipoises (cp.)

All chlorinations followed by washing, treatment with 2% caustic soda solution (based upon dry weight of pulp), and again washing.

In view of these unexpected departures from the common conception that there is little, if any, degradation of cellulose during chlorination at low density and at room temperature and that the rate of reaction in chlorination is usually rapid, a more detailed and comparative study of varying sequence and degrees of treatment were made. Five runs were made under the conditions outlined and, with the results, are given in Table II.

These data show that, with the use of 5% of chlorine in single-stage chlorination and with the time of treatment not over one hour, the degradation of the cellulose, as is shown by the cuprammonium viscosity, is negligible. The use of calcium hypochlorite in amounts equivalent to over 3% of chlorine, or for periods of time necessary to exhaust the active chlorine that was substantially over 20 minutes, showed serious degradation.

The second-stage treatments with either chlorine or hypochlorite required three hours or more to exhaust the chemical, and serious degradation resulted.

The third-stage treatments with hypochlorite showed long periods of time for exhaustion and serious degradation of the cellulose in all cases except one. In this case, however, the degradation in the earlier stages was already much greater than for any of the others.

It is apparent that 5% chlorine in the form of hypochlorite is much less degrading in the first stage than even 1% chlorine (as chlorine) in the second stage. The degree of degradation in the second stage is greater, the greater the amount of chlorine used and the time taken to consume it; to a considerable extent, reduction in the amount of chlorine used in this stage will compensate for the extended time required for the reaction when a greater proportion of the total purification is accomplished in the first stage accompanied by a greater degree of degradation.

Chlorination following chlorine is much more degrading than chlorination following hypochlorite when comparable amounts are used in each stage; the latter is much more degrading than hypochlorite following chlorination.

Degradation is considerable where the time of contact with either reagent is considerable. Loesch brandt points out *(24)* that the extended time required, when the rate of the primary reaction in liberating and solubilizing the noncellulosic substances is low, causes a relatively greater attack on the cellulose in producing a bleached product. These results agree with his observations and it seemed desirable to ascertain how far the rate of reaction during the second stage could be accelerated by carrying on the treatment at a higher consistency. Pulp prebleached with hypochlorite equivalent to 5% chlorine was treated with 3% chlorine at 25 deg. C. and at 3% and 25% consistency. The effects produced are shown in Table III. The preliminary bleaching was carried out at 20 deg. C., 15% consistency for 15 minutes, and the resulting cuprammonium viscosity of the pulp was 49 centipoises.

TABLE III.—EFFECT OF CONSISTENCY DURING CHLORINATION

Consistency, %	3	25
Permanganate number	3.28	3.46
Cuprammonium viscosity, cp.	20	18
Time to exhaustion, min.	175	122
Final brightness, %	51	51

It is evident that it is not possible to materially increase the rate of chlorination in the second stage by increasing the pulp consistency at which the chlorination is conducted. The degradation caused by the increased concentration of reagent more than offsets any benefits obtained from the reduction in time.

The effect of consistency in the treatment of pulp with hypochlorite in the first stage is shown in Table IV. Hypochlorite equivalent to 5% chlorine was used at a temperature of 20 deg. C.

TABLE IV.—EFFECT OF CONSISTENCY DURING HYPOCHLORITE TREATMENT FIRST STAGE

Consistency, %	3	10	25
Permanganate number	8.7	8.3	8.3
Cuprammonium viscosity, cp.	57	52	49
Time to exhaustion, min.	85	35	15
Final brightness, %	43	..	40

It is evident that in the first stage the effect of consistency on the rate of reaction of hypochlorite is more pronounced. The time involved was so brief in all cases, however, that the concentration of the active chlorine had a greater effect on the degradation of the cellulose than did the time of the reaction.

Table V shows the results obtained when the chlorinations were limited to periods of one hour.

TABLE V.—BLEACHING WITH CHLORINATION LIMITED TO ONE HOUR

Chemical added	Equivalent Chlorine added, %	Used, %	Consistency, %	Temperature, °C.	Time, min.	Viscosity, cp.	Permanganate number
First Stage—Hypochlorite ..	5.0	5.0	10	20	33	52.0	8.75
Second Stage—Chlorine	2.50	2.22	3	20	60	28.8	3.55
Third Stage—Hypochlorite ..	1.20	0.94	10	21	180	21.6	1.65
Fourth Stage—Chlorine	0.60	0.24	3	20	60	20.0	1.59

A comparison of these data with Experiment 5, shown in Table I, shows that no improvement results from the milder treatments made possible by an additional stage, beyond a slight reduction in final permanganate number.

The relationship between rate of chlorine consumption and rate of degradation of the cellulose during chlorination in the second stage is shown in Fig. 3. The first-stage treatment used in preparing the pulp was treatment with hypochlorite equivalent to 5% bleach at 20 deg. C. and at 3% consistency. The con-

dition for the second-stage treatment was also at 3% consistency and 20 deg. C. It is evident that the rate of degradation and the rate of chlorine consumption closely parallel each other and that the principal action would seem to be upon the cellulose. This would seem to indicate the futility of using chlorination as the second-stage treatment of kraft pulp with any reasonable hope of attaining the necessary bleaching with less degradation than occurs in the use of hypochlorite under proper conditions. It also points to the futility of using chlorination in this stage with the object of speeding up the operation.

The relationship between rate of chlorine consumption and the rate of degradation of the cellulose during chlorination in the first stage is shown in Fig. 4. The reaction was carried out at 20 deg. C. and 3% pulp consistency. Chlorine was present at the start to the extent of 8% of the weight of the unbleached pulp.

It is evident that the rate of reaction is so much greater than the rate of degradation of the cellulose during the first 10 minutes that little degradation occurs before 5.6% of chlorine has been consumed. The use of this amount of chlorine for the first stage would give the greatest proportion of the total amount of treatment required with the least over-all degradation of the cellulose.

Use of no more chlorine than is consumed in the reaction period is shown in Experiments 4 and 8 given in Table I to produce less degradation than the consumption of the same amounts in the presence of a substantial excess as was the case in the experiment presented in Fig. 4. For the pulp in question, it is evident that a bleached pulp of somewhat higher viscosity could have been obtained by the use of 5.6% of chlorine in the first stage.

Conclusion

Chlorination with 5% of chlorine in the first stage is less degrading to the cellulose of bleached kraft pulp from jack pine than with 1% of chlorine in the second stage. The degree of degradation in the second stage is greater, the larger the amount of chlorine used and the longer the period of time taken to consume it. The rate of reaction by the use of chlorine in the second stage is very much slower than its use on the unbleached pulp in the first stage.

Chlorination following chlorine treatment is very much more degrading to the cellulose than chlorination following hypochlorite when comparable amounts

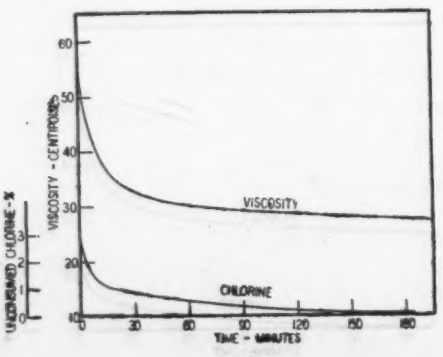


FIG. 3
Second-Stage Chlorination

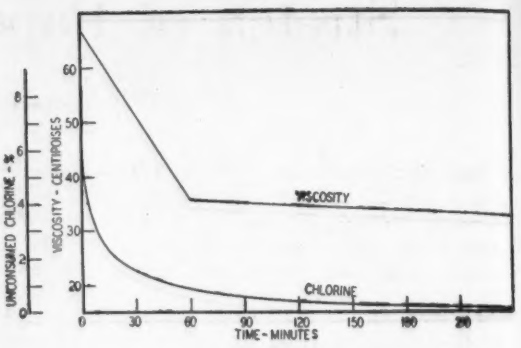


FIG. 4
Chlorination of Unbleached Pulp (8% Available Chlorine)

are used in each stage; the latter is much more degrading than hypochlorite following chlorination.

The degradation caused by increased concentration of chlorine at increased pulp consistencies more than offsets any benefits obtained from reduction in the required time for its exhaustion.

The degradation caused by increased concentration of hypochlorite in the first stage at increased pulp consistencies more than offsets any reduction in degradation by the decrease in the time required for the completion of the reaction.

If the chlorination is stopped with some of the chlorine unconsumed, there is no reduction in the degradation of cellulose to bleach to a standard brightness.

In the second-stage chlorination, the rates of consumption of chlorine and the degradation of the cellulose are closely parallel, so that there is no point at which to obtain optimum results.

In the first-stage chlorination, the rates of consumption of chlorine during the first ten minutes are relatively much greater than the rate of degradation of the cellulose. After 60 minutes, the rates are approximately parallel. It is therefore possible to choose an amount of chlorination in the first stage for any kraft pulp that will permit the required degree of bleaching with minimum over-all reduction in viscosity.

Literature Cited

1. Bevan, E. J., and Cross, C. F., *J. Chem. Soc.* 38:666-668 (1880).
2. Cirves, Francis J., *Paper Trade J.* 95, no. 7:32-37 (Aug. 18, 1932); *Tech. Assoc. Papers* 16:447-451 (1933).
3. Curran, C. E., Doughty, R. H., and Bray, M. W., *Paper Trade J.* 92, no. 2:45-52 (Jan. 8, 1931); *Tech. Assoc. Papers.* 14:365-372 (1931).
4. De Vains, Antoine Regnouf, U. S. patent 1,106,994 (Aug. 11, 1914).
5. Egan, Omar S., Can. patent 300,674 (June 3, 1930); *C. A.* 24:3648 (1930).
6. Forster, A., and Pearman, Sydney A., *J. Soc. Chem. Ind.* 44:233T-241T (1925).
7. Hägglund, Erik, and Urban, Helmut, *Acta Acad. Aboensis, Math. et Phys.* 4:3-19 (1928).
8. Hatch, Raymond S., *Paper Trade J.* 89, no. 18:135-139 (Oct. 31, 1929).
9. Heuser, Emil, *Pulp Paper Mag. Can.* 30:101-104, 116 (1930).
10. Heuser, Emil, and Niethammer, W., *Papier-Fabr.*, 21, Fest- u. Ausland-heft 52-60 (1923); *C. A.* 17:3918 (1923).
11. Hochberger, Ernst, *Papier-Fabr.* 26, no. 23A:66-88 (June, 1928).
12. Michel-Jaffard, R., *Papier* 26:77-84, 197-202, 321-329, 571-579, 929-935, 1077-1080, 1187-1195 (1923); 27:213, 215, 217, 219 (1924).
13. Pomilio, Umberto, *Wochbl. Papierfabr.* 56-1115-1121 (1925).
14. Richter, George A., and Schur. Milton O., U. S. patent 1,639,704 (Aug. 23, 1927).
15. Rue, John D., U. S. patent 1,771,064 (July 22, 1930).
16. Rue, John D., and Sconce, James S., *Paper Trade J.* 95, no. 17:54-62 (Oct. 27, 1932); *Tech. Assoc. Papers* 16:503-511 (1933).
17. Rys, L., *Paper Trade J.* 88, no. 1:65-72 (Jan. 3, 1929).
18. Strachan, James, *Paper-Maker* 84:TS257-258 (1932).
19. Sunesson, Erik Bror Fredrik, U. S. patent 2,140,863 (Dec. 20, 1938).
20. Sutermeister, E., *Paper Ind.* 4:517-522 (1922-1923).
21. Wells, Sidney D., *J. Ind. Eng. Chem.* 13:936-939 (1921).
22. Wells, Sidney D., U. S. patent 1,883,193 (Oct. 18, 1932).
23. Wenzl, Hermann, *Papier-Fabr.* 29:49-55 (1931).
24. Loeschbrandt, F. "Bleaching of Sulphate Pulp". TAPPI, New York, 1941. (Translated by E. Martin).

Stretch of Paper and Paperboard

TAPPI Tentative Standard T 457 m-42

The stretch of a paper is important, whenever a web is handled under tension because, together with its tensile breaking strength, the stretch is closely related to the initial tearing strength. A satisfactory stretch is necessary for a sheet to fold well and to resist local stresses, as when used for packaging. It is also important in twisting papers, cable papers, corrugating board, toweling and tissues. Stretch is also a factor in the bursting strength test—a sheet of high stretch has a greater bursting strength than a sheet of the same tensile strength but possessing a lower stretch.

The numerical result includes not only both the elastic and the inelastic stretch of the paper up to failure but also the small distance through which the broken strip will elongate during the test while being held together by protruding fibers, as this factor prevents the indicating mechanism from being released at the reading when the break starts. For this reason the test may be termed more correctly "the percentage elongation of a strip of paper up to, and partly including, rupture under tension."

Apparatus

(The following requirements, except Items 2 and 4, are the same as for the tensile breaking strength apparatus in TAPPI Standard T 404 m.)

The instrument used shall have: 1. Two clamps whose centers shall be in the same plane parallel with the direction of motion of the applied stress and so aligned that they will hold the test specimen in one plane throughout the test without slippage. At the start of the test the edges of the jaws of the clamps shall be 180 ± 10 mm. (7.09 ± 0.04 inches) apart, except that for coarse papers, such as building papers, and for paperboards over 0.012 inch thick, the distance may be from 152 mm. (6.0 inches) to 203 mm. (8.0 inches).

2. Means of applying a predetermined initial tension to the test specimen while it is being clamped.

3. Means of applying a gradually increasing load to the test specimen until it breaks, the increase being such that the additional load applied each second is not different by more than 5% from the additional load applied in the previous second. (This condition is fulfilled by the usual pendulum type of apparatus.)

4. Means of indicating the elongation of the test specimen up to the instant of complete fracture to an accuracy of within 0.5 mm. (0.02 inch).

Calibration

With the pendulum type of tester, clamp the pendulum at zero, set the lower clamp near the upper clamp and set the stretch indicator at zero, with the trigger mechanism operating the stretch indicator adjusted to and engaged with the lower clamp. With inside vernier calipers measure the distance between the clamps to the nearest 0.01 inch (0.2 mm.). Move the lower clamp down a little distance and again measure the distance between the clamps. The indicated reading should correspond with the difference between the two vernier readings. Repeat the same procedure for various points along the elongation scale.

An alternative method of calibration is as follows: Grip a heavy rubber strip between the clamps of the tester and compare the changes in the indicated readings with the distances between the clamps, as measured with vernier calipers, using a rule with squared ends to extend the range of the calipers if required.

If necessary, prepare a calibration table or chart for applying any corrections.

To ensure that the stretch-indicating mechanism is stable, place the pendulum in position about halfway up the scale, set the stretch indicator at some intermediate position, and then jar the instrument slightly and note whether the stretch indicator moves. If it does move, either the stretch mechanism must be counterbalanced or the spring friction holding it in position must be increased. Otherwise a serious error may be caused in the reading by the jar that occurs, especially when a strong specimen breaks under test.

Unless the apparatus is altered in any vital way, there is no need to repeat the calibration once it has been established; but if the stretch-indicating mechanism is not counterbalanced, it should be tested for stability to jarring from time to time.

Test Specimen

The requirements for the test specimens are the same as for the tensile breaking strength method, TAPPI Standard T 404 m. They shall be strips cut accurately and parallel to within 0.1 mm. and with clean edges, in each principal direction of the paper, and over 200 mm., preferably 250 mm. (9.9 inches) long. The width shall be 12.7 mm. (0.5 inch), 15.0 mm. (0.59 inch) or 15.9 mm. (0.625 inch), except that for coarse papers, such as building papers, or for paperboards over 0.012 inch thick, the width may be 1 inch or 2 inches. The specimens shall be conditioned according to TAPPI Standard T 402 m. They shall be free from abnormalities, watermarks, creases and wrinkles.

Procedure

The test shall be made in an atmosphere condition according to TAPPI Standard T 402 m.

Load each specimen in the following manner[1] until it breaks.

1. For weak papers such as tissues, paper towels, newsprint, etc., requiring a breaking load of five pounds (2.3 kg.) or less, have the machine speed so adjusted that fracture occurs in not less than 5 nor more than 15 seconds.

2. For other papers, and paperboards, requiring a breaking load of not more than 30 pounds (13.6 kg.) use a constant rate of loading of about 1 ± 0.32 pound (0.45 ± 0.15 kg.) per second.

3. For papers and paperboards requiring a breaking load of more than 30 pounds (13.6 kg.), adjust the machine speed so that fracture occurs in not less than 30 nor more than 45 seconds.

The appropriate rate of loading may be determined from a trial test strip.

[1] Items 1, 2 and 3 are the same as for Standard T 404 m.

Tightly grip one end of each strip in the upper clamp after placing the strip loosely in the lower clamp and checking its alignment. Then apply an initial stress of 0.5 pound (0.23 kg.) to each strip before clamping, except for papers having a tensile strength of less than 5.0 pounds (2.3 kg.). In the latter case, subject two or three test specimens from the same sample of paper to a preliminary tensile test and apply an initial tension equal to 10 ± 2.5% of the average break load so determined, to each strip while being clamped (*see* notes). With apparatus in which the test specimen is clamped vertically, this is conveniently done by temporarily clipping a suitable weight to the lower protruding end of the strip, before tightening the lower clamp. Tightly clamp both ends of the strip and apply the load.

Reject readings from individual strips if the strip slips or breaks in or at the edge of the clamps. Record the result of each individual reading to two significant figures.

Test at least 10, and preferably 20, strips cut in each principal direction of the paper.

If the mean value of the lowest and the highest reading differs from the average of all the readings by more than 5%, test more specimens until there is agreement within this limit. In the case of an irregular sheet of paper, it therefore may be necessary to conduct a much larger number of tests than ten. An isolated very high or low result, which is not repeated in duplicate, shall be discarded when a consistent average is obtained without the abnormal reading.

Report

Results obtained on strips cut in the machine direction shall be reported as stretch, machine direction, and results obtained on strips cut in the cross direction shall be reported as stretch, cross direction. The average value of the results on the individual strips shall be reported as a percentage of the length between the clamps, to one decimal place.

A complete report requires in addition:

1. Maximum and minimum results and number of strips tested.
2. The length of the test specimen—i.e., the distance between clamps at the start of the test.
3. The width of the test specimen.
4. A statement of the rate of loading used.

Reproducibility of Results

Duplicate determinations of different sets of samples from the same shipment, and on different testing instruments are expected to agree to within 0.2 for results of 2.0 or less, and within 10% for higher results.

Notes

1. The initial load on the strips specified in the procedure is to remove any cockles or waviness which might be present. With most papers this small initial load will not cause any sensible extension beyond removing the defects mentioned. The value of the initial tension is not critical for flat papers; hence, except for very precise work, it is sufficient to remove the waviness or cockles by application of a slight tension to the strip with the fingers before tightening the clamp in the tester.

2. The stretch test for some papers is not appreciably influenced by the rate of loading, while for others, especially creped papers, doubling the rate of loading may increase the result by as much as 5% of the recorded amount.

3. If a smaller distance between the clamps is employed, a higher test may be expected, since the elongation after the initial fracture has been made is appreciable and is independent of the length of the strip used. Like the tensile breaking strength test, the effect of the length of strip on the stretch is also somewhat dependent upon the formation of the sheet. In addition, the accurate indication of stretch for strips much less than 180 mm. is open to question unless unusually good apparatus is employed. Varying the width of the test specimen between 12 mm. and 25 mm., with a proportionate rate of loading, does not in general make much difference to the test results, except for unbeaten long-fibered papers, where the differences may be appreciable—perhaps 10% of the recorded amount.

4. The test is designed to be carried out, if desirable, at the same time as the standard method for determining the tensile strength. For precise work or for papers having a relatively low stretch (less than 2%), the stretch attachment to the usual pendulum tester is not very accurate, because deficiencies in the release mechanism tend to give unduly high results. An instrument especially designed for measuring stretch according to this method is available, in which the sample is clamped under a predetermined tension in a horizontal plane and the load is applied transversely to the center of the strip by a plunger moving vertically. The stretch of the strip before breaking is indicated by a scale on the plunger or computed from the vernier, showing the distance which the plunger traveled before the strip broke.

References

Houston, Paul L. "Effect of Length and Width of Test Specimen on the Breaking Strength and Elongation of Paper." *Paper Trade J.* 76, no. 12:54-55 (March 22, 1923); *Technical Association Papers* 6:72-73 (1923).

Clark, James d'A. "Some Observations on Burst, Tensile, and Stretch Tests." *Paper Trade J.* 102, no. 2:40-42 (Jan. 9, 1936); *Technical Association Papers* 19:264-266 (1936).

Instrumentation Studies—Report No. 36. "The Measurement of the Stretch of Paper." New York, American Paper and Pulp Association (Feb. 10, 1942).

REPRINT NOTE: Reprints of TAPPI Tentative Standard T 457 m-42 may be obtained from the Technical Association of the Pulp and Paper Industry, 122 East 42nd St., New York, N. Y., at 25 cents each.

Urge I. P. Co. Mill for Aluminum Plant

[FROM OUR REGULAR CORRESPONDENT]

PIERCEFIELD, N. Y., August 10, 1942—Commercial organizations in this section are endeavoring to secure one of the proposed government aluminum plants now under consideration for this state. Telegrams and letters calling attention to the plant and power facilities of the abandoned plant of the International Paper Company, in this village, the available housing and labor supply, and the need for some war industry to bolster the industrial situation have been sent to government officials and a petition is now being circulated which will bear the signatures of several hundred residents urging this section as a site for the war industry plant. The big paper mill has not been in operation for some years and many empty houses are near the site. The water power is owned by the paper company and labor is abundant in an area which has no defense industry. A letter to Governor Lehman pointed out that the mill is a fireproof brick plant, 1,000 by 250 feet in dimensions, and was erected in 1904. Full details of the layout, equipment and power output were supplied. A government official wired that that the War Production Board is now considering sites at Cannonsburg, Erie, Pa., and Oswego.

Estimation of the Dialdehyde Type of Oxidation in Oxystarches and Oxycelluloses*

By D. H. Grangaard,[1] E. K. Gladding[2], and C. B. Purves[3]

Abstract

Periodic acid is known to oxidize starch and cellulose by changing the glucose residues, of which they consist, into chains of half acetals of glyoxal with two erythrose units. The action of boiling, 10% methanolic hydrogen chloride on periodate oxystarch was found to produce about half the expected amount of glyoxal tetramethyl acetal, which was isolated by means of its volatility in steam and which was quantitatively estimated as glyoxal, either colorimetrically or by precipitation with 2, 4-dinitrophenylhydrazine.

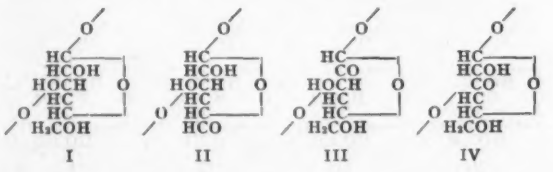
The other half of the glyoxal residues in the oxystarch condensed with the erythrose present during methanolysis to form a cyclic acetal thought to contain a 1, 4-dioxane ring. Control experiments with this cyclic acetal showed that it was only slightly volatile in steam and interfered in a reproducible way with the estimation of the tetramethyl acetal. When the analytical method was extended to include both acetals, it recovered at least 90% of the glyoxal units theoretically present in periodate oxystarch or oxycellulose. Rate studies on the oxidation of starch by aqueous periodate showed that the reaction was selective only below 20 deg. C. and within the limits pH 2-5 and in these circumstances was 90-95% efficient. This result supported the validity of the analytical method.

Properly prepared periodate oxycelluloses also had analyses corresponding to about 90% of dialdehyde oxidation and perhaps a trace of the same type of oxidation was present in a permanganate oxycellulose. Entirely negative results were obtained in preliminary experiments with persulphate, hypobromite, hypochlorite, nitric acid and dichromate products. The striking differences between the properties of periodate and dichromate oxycelluloses are therefore due, as Davidson assumed [J. Text. Inst., 32, T 109 (1941)], to a radical difference in the chemical nature of the two oxidations.

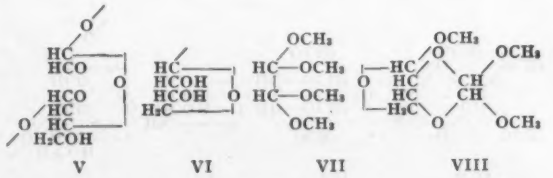
General considerations drawn from organic chemistry suggest that the different copper reducing structures initially produced from cellulose by any oxidant do not exceed four in number. The present article, by describing methods for detecting and estimating one of these possible structures, has simplified the outstanding problem of determining the course of the oxidation in cases of technical importance, such as those encountered as a result of overbleaching.

Although the oxidation of starch and cellulose has been very extensively studied since the time of Witz *(19)*, the information gained has been almost entirely of a qualitative nature and has dealt in the main with the physical deterioration that oxidation causes in textiles. Oxidations often produce byproducts of low molecular weight among which carbon dioxide, the fatty acids from formic to butyric and "uronic acid" residues may be mentioned *(12)*. The admirable work of Clibbens, Geake and their associates clearly shows that oxidants may be chosen to produce oxycelluloses tending to one or other of two extreme types, which are rich in carboxyl groups or in copper-reducing carbonyl groups respectively. Physical properties such as tensile strength, stability to and solubility in alkali and viscosity characteristics, can be correlated in a qualitative way with the two types of product. This work has been reviewed by Doree *(6)*. Further progress in the field would be helped by an increased ability to characterize oxystarches and oxycelluloses and to differentiate those produced by one set of oxidizing conditions from those produced by another. This problem resolves itself into a need for more chemical analytical methods with which to estimate the various kinds of oxidation encountered in practice.

The anhydroglucose units of which both starch and cellulose are composed have the Structure I. General chemical considerations suggest that the reducing products initially formed in oxidations probably have the Structures II to V, where III and IV may be identical by virtue of a common enol form.



I II III IV



V VI VII VIII

A single glucose residue, of course, may be oxidized in more than one of these ways and some further oxidation leading to carboxy groups will usually occur, even with carefully controlled conditions. The immediate task, therefore, is to work out separate analytical methods for II to V, when these are present in a mixture possibly containing all of them, together with much unchanged starch or cellulose. The present article is restricted to the estima-

* Presented at the Annual Meeting of the Technical Association of the Pulp and Paper Industry, Hotel Commodore, New York, N. Y., Feb. 16-19, 1942.

[1] Kimberly Clark Corporation, Neenah, Wis.

[2] Research Associate, Massachusetts Institute of Technology, Cambridge, Mass.

[3] Member TAPPI, Associate Professor of Organic Chemistry, Massachusetts Institute of Technology, Cambridge, Mass.

tion of the dialdehyde mode of oxidation (V), which was found by Jackson and Hudson *(13)* to be the dominant product formed by periodic acid. Periodate oxystarch or oxycellulose gave 22 and 33% yields of erythrose and glyoxal, respectively, on acid hydrolysis and also were soluble in methanol. These observations suggested that methanolysis should produce methylerythroside (VI) and glyoxal tetramethyl acetal (VII). The latter was readily estimated quantitatively and was volatile in steam *(8)*. Methanolysis, followed by a steam distillation from an aqueous *alkaline* solution (to retain any acidic substances) was therefore expected to isolate the tetramethyl acetal and thereby provide a quantitative estimation of the dialdehyde type of oxidation. Acetals are stable in aqueous alkali although unstable in aqueous acid.

In order to work out these principles quantitatively, it was desirable to prepare a periodate oxystarch containing a definitely known amount of Structure V. The oxidation of starch or cellulose with aqueous periodate takes place in a heterogeneous system and it is possible that some of the oxidant is dissipated in secondary reactions at the surfaces while the interiors of the granules or fibers contain unchanged starch or cellulose. This problem was investigated by studying the rate at which oxidation occurred in a more homogeneous system consisting of soluble starch dissolved in aqueous buffers containing a five-fold excess of periodate. The data (Figs. 1, 2, and 3), show clearly that the initial oxidation product was most stable in the unused excess of the reagent within the limits pH 2 to 5 and at a temperature not exceeding 25 deg. C. The continuing upward slope of the plots outside these limits, and beyond one mole of periodate per glucose unit, were due to undesirable secondary oxidations. It is possible that degradation of the oxystarch by hydrolysis on the acid side of pH 2 and its extreme instability in alkali, were responsible for these secondary effects. Davidson *(5)* has pointed out the sensitivity of periodate oxycellulose to weak alkali and unpublished data *(14)* show that yarn oxidized with periodate rapidly decreased in tensile strength even when kept in water at 25 deg. C. and buffered to pH 7.0 with 0.5 *M* sodium acetate. These secondary oxidations reduced the iodate as well as the periodate ion, because all of the iodine was deposited in the crystalline form when the oxidations were prolonged for many weeks. Nevertheless, the secondary oxidation at pH 4.2 and not more than 20 deg. C., for reasonably short periods, was minor and there were solid grounds for believing that 90 to 95% of the

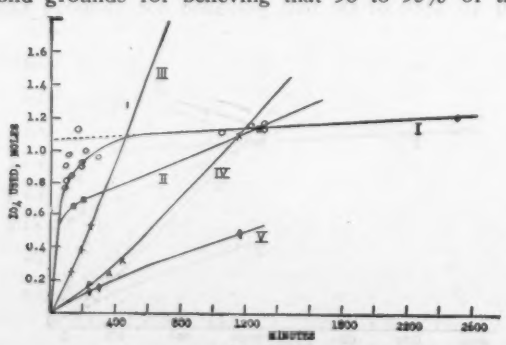


FIG. 1

Oxidation of 1 Mole of Soluble Starch with 5 Moles of Periodate at 25 Dec. C. Curve I, Composite Curve, pH 2.05 to 4.8 (*See* Fig. 2). Curve II, pH 0.7. Curve III, pH 8.2. Curve IV, pH 9.75. Curve V, pH 11.5.

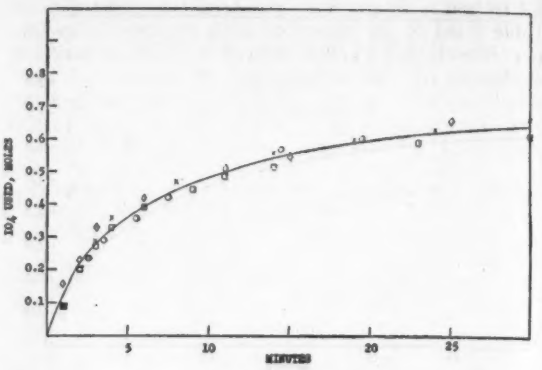


FIG. 2

Initial Oxidation of 1 Mole of Soluble Starch with 5 Moles of Periodate at 25 Deg. C. pH 2.05, O. pH 4.0, □. pH 4.55, ◇. pH 4.8, ×.

periodate consumed produced oxidation of the desired dialdehyde type. It is interesting to note that the break in the oxidation-rate plots (Figs. 1 and 3) corresponded to 1.05 to 1.10 mole of periodate rather than to the 1.00 mole demanded by theory. The excess was possibly caused by the terminal groups of the starch chain, each of which reduced two or three moles of periodate, or to the protein present in the starch used. Since the rate plots just discussed for soluble starch were practically superposable on those obtained with the insoluble, powdered variety, it was reasonable to adopt a similar interpretation for both cases and to conclude that the periodate ion passed rapidly to the interior of the starch micelle (Fig. 3). Although Davidson *(5)* showed by X-ray methods that the cellulose micelle also was penetrated, the diffusion was apparently slow enough to diminish the rate of oxidation markedly long before one mole of periodate per glucose unit was consumed (Fig. 3).

The foregoing work resulted in the preparation of periodate oxystarches in which the amount of the dialdehyde cleavage very probably corresponded to 90 to 95% of the periodate consumed. These specimens were used as a yardstick against which the yield of glyoxal tetramethyl acetal, recovered after varying conditions of methanolysis, was measured. After the methanolyses, the solutions were made alkaline, then steam distilled and the tetramethyl acetal estimated in the first 500 cc. of the distillate.

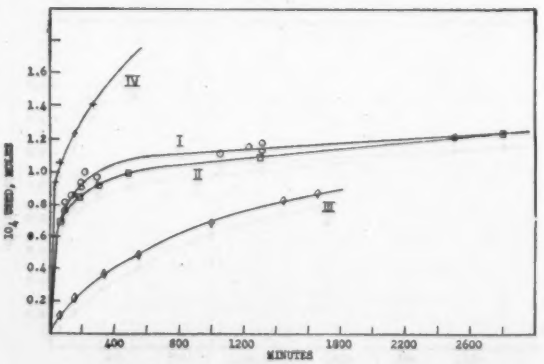


FIG. 3

Oxidation of 1 Mole of Starch or Cellulose with 5 Moles of Periodate at pH 4.25. Curve I, Soluble Starch at 25 Deg. C. Curve II, Powdered, Insoluble Starch at 25 Deg. C. Curve III, Highly Swollen Cotton Linters at 25 Deg. C. Curve IV, Powdered, Insoluble Starch at 60 Deg. C.

All technical details were standardized. The data in Table I led to the choice of 10% methanolic hydrogen chloride and a reflux time of 3 hours as standard conditions for the methanolysis of oxystarch. Periodate oxycellulose took longer to disintegrate and the time was extended to 18 hours. In no case did the yield of glyoxal tetramethyl acetal approach the expected value of 90 to 95%. The cause of this discrepancy was finally traced to the fact that the methanolysis of the oxystarch is not a clean-cut reaction. About half produces the glyoxal tetramethyl acetal (VII) expected, but the other half is degraded and rearranged to a mixture of isomeric substances (VIII), together with homologues of higher molecular weight. These 1, 4 dioxane derivatives have been described elsewhere *(9, 16)*. As the compounds (VIII) are only slightly volatile in steam, the glyoxal residues they contain are not completely estimated by the method used. Separate control experiments on the steam distillation characteristics of the tetramethyl acetal and the cyclic acetal mixture (VIII) gave the data for Fig. 4 (*see* Table IV), whence it appeared that the first 200 cc. of distillate contained 96.2% of all the tetramethyl acetal and 9.3% of all the cyclic acetal originally in the still. The figures for the second 200 cc. volume were 2 and 46%, respectively. The two fractions of distillate were separately hydrolyzed and the liberated glyoxal was estimated from the weight of the precipitate with 2, 4-dinitrophenylhydrazine *(8)*. A simultaneous equation was set up to connect the amounts of the two kinds of acetal originally in the still with the total amount of glyoxal found in each fraction of distillate. It was then easy to calculate the amount of type V oxidation in the oxystarch or oxycellulose sample. The glyoxal also was estimated by a shorter but less reliable colorimetric method *(8)*. Other control experiments confirmed the fact that the tetramethyl acetal gave a quantitative yield of glyoxal when hydrolyzed. Hydrolysis of the cyclic acetal gave yields of glyoxal which were reproducible but not quantitative.

TABLE I.—RECOVERY OF GLYOXAL TETRAMETHYL ACETAL AFTER VARIOUS CONDITIONS OF METHANOLYSIS[a]

Catalyst,[b] %	Refluxed, hours	Recovery, %	Catalyst,[b] %	Refluxed, hours	Recovery, %
2.5[c]	4	0	1 [c]	17	29.4
4 [d]	5	17.2	1.2[c]	4	32.4
2.7[c]	11		5.4[c]	6.5	41.0
5 [d]	2	34.1	10 [c]	1	37.2
11 [c]	3	49.5			42.6
10 [d]			10 [c]	1.75	46.6
2 [c]	4 [f]	32.9	10 [e]	2.5	42.3
1 [c]	8.5[f]	34.6			55.6

(a) Ratio of oxystarch to methanol about 1:200.
(b) Percentage based on methanol.
(c) Benzene sulphonic acid.
(d) Anhydrous zinc chloride.
(e) Anhydrous hydrogen chloride.
(f) Heated in an autoclave at 100 deg. C.

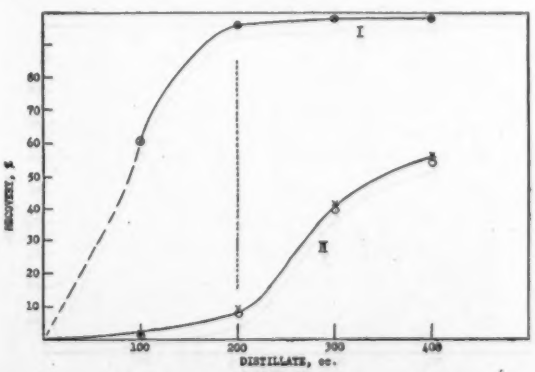


FIG. 4

Recovery of the Acetals in a Standardized Steam Distillation. Plot I, Glyoxal Tetramethyl Acetal, X, 0.0457 Gram, O, 0.0914 Gram Sample. Plot II, The Cyclic (1,4 Dioxane) Acetal, X, 0.1078 Gram, O, 0.0764 Gram Sample.

Oxidations with Periodate

Starches Used

A high grade commercial potato starch with 0.23, 0.55, and 14.9% ash, nitrogen, and moisture, respectively, was used without further purification in much preliminary work. Soluble starch was made from it by digestion with 0.5% ethanolic hydrogen chloride according to Baird, Haworth, and Hirst *(2)* and was purified by precipitating the aqueous solution with alcohol. The product stained clear blue with iodine and after drying in a desiccator had 0.19% ash and 1.7% moisture. Sample weights were corrected for these impurities.

Oxidation of Starches with Periodate

Sodium paraperiodate, $Na_3H_2IO_6$, was used in experiments run on the acid side, and potassium metaperiodate, KIO_4, in those on the alkaline side of neutrality. The oxidizing agent (0.01 mole) was dissolved in 400 cc. of either a molar acetate or a molar phosphate buffer made from either sodium or potassium salts. This buffer was sufficient to limit the change in pH during the oxidations to less than 0.1, as measured on a glass electrode. A bath at 25±0.5 deg. C. maintained the temperature of the solution, which was mechanically stirred while 0.002 mole (0.324 gram, corrected) of the soluble starch was added.

The disappearance of periodate in the solution was followed by a slight modification of Fleury and Lange's method *(7)*. Aliquots, 15 cc., were pipetted into exactly 10 cc. of $N/10$ arsenious oxide solution to which 1 cc. of 20% potassium iodide had been added. This procedure promptly stopped the oxidation by reducing all of the periodate. Runs made on the acid side were then buffered with a fixed amount of molar potassium carbonate, those on the alkaline side with freshly prepared sodium bicarbonate or a small lump of dry ice, so that in each case a pH of 7.7 to 8.0 was obtained. This pH was necessary in the final titration with $N/50$ iodine solution, which was carried out after waiting for 15 minutes. The difference between the titration and the blank, expressed as x liters of N iodine, was equivalent to $x/2$ moles of periodate. Figures 1, 2, and 3 summarize the data.

Larger scale, 20- to 50-gram, oxidations of the insoluble starch were carried out as described by Michell and Purves *(16)* in a solution buffered to pH 4.2 and cooled externally to keep the temperature below 20 deg. C. When dried directly from water, the product formed such hard clots that it could scarcely be powdered in a mortar. Drying through alcohol and benzene left the product as a powdery, friable mass. The yield was 105 to 110% of theory, probably because water was most tenaciously retained. All the other yields quoted in this article are based on the moles of periodate used in making one gram of the oxystarch or oxycellulose.

Periodate Oxycellulose

A dewaxed, high-grade cotton linter was swollen

in 10% sodium hydroxide at 10 deg. C., washed quite free of alkali with water, dilute acetic acid and water, then dried through alcohol and benzene. The internal surface directly available to liquid reagents contained 10 to 20% of all the hydroxyl groups in the cellulose *(10)*.

In a typical preparation, 5.02 grams (1 mole) were shaken at 20 deg. C. with 7.75 grams (0.852 mole) of sodium paraperiodate and 175 cc. of molar acetate buffer, pH 4.2. The product was isolated after 43 hours, when 0.724 mole of periodate had been consumed, and weighed 5.06 grams. This oxycellulose corresponded to 0.00442 mole of oxidant per gram. Other preparations had 0.0047 and 0.00234 moles.

Estimation of the Dialdehyde Cleavage

The sample, 0.1 to 0.2 gram, of the oxystarch or oxycellulose was boiled under reflux for 18 hours with 25 cc. of methanol containing 2.5 grams of hydrogen chloride gas. After cooling, the solution was made alkaline with 20 cc. of nearly saturated sodium methylate in methanol and the volume was adjusted with methanol to 52 cc. The alkaline solution was quantitatively transferred to a 500-cc. distilling flask with exactly 300 cc. of an aqueous solution containing 6.5 grams of sodium chloride and 1 gram of sodium hydroxide. A water condenser was used in the atmospheric pressure distillation and the first, second, and third 100-cc. volumes of distillate were collected separately. Water, 100 cc., was then added in one portion to the still and a fourth 100 cc. of distillate was collected. A 50-cc. aliquot of each of the four distillates was diluted with an equal volume of 2*N* hydrochloric acid and hydrolyzed by heating for one hour on the steam bath. The hydrolyzates were then examined either by the 2, 4 dinitrophenylhydrazine or the colorimetric method now to be described.

The 2, 4-Dinitrophenylhydrazine Method

A nearly saturated solution of the phenyhydrazine, 50 cc., containing 0.38 gram, and 2*N* in hydrochloric acid, was added to 50 cc. of each hydrolyzed fraction and, after warming the mixture on the steam bath until precipitation was complete, the precipitate that had formed was filtered, dried and weighed. In a particular experiment, an 0.1226-gram sample of periodate oxystarch deposited precipitates weighing 0.1054, 0.0636, 0.0508, and 0.0240 gram from the four successive volumes of distillate. If w and w_1 were the weights of precipitate corresponding to all the tetramethyl and the cyclic acetal originally in the still, the distillation characteristics of these substances (Fig. 4, Table IV) show that

$$\left.\begin{array}{l} 0.1054 + 0.0636 = 0.96w + 0.093w_1 \\ \text{and } 0.0508 + 0.0240 = 0.02w + 0.46w_1 \end{array}\right\}$$

whence w was 0.159 and w_1 was 0.155 gram.

Since the hydrolysis of the tetramethyl acetal to glyoxal and the precipitation of the latter as the bis-2, 4-dinitrophenylhydrazine are quantitative reactions *(8)* (Table II) allowance for the change in molecular weight gave 0.139w gram of glyoxal from the tetramethyl acetal. Control experiments (Table II) showed that w_1 gram of precipitate from the cyclic acetal corresponded to 0.075 w_1 gram of glyoxal. The substitution of the known values for w and w_1 in the formula

$$0.139w + 0.075w_1$$

gave 0.0337 gram as the total amount of glyoxal recovered from the 0.1226 gram sample of periodate oxystarch—i. e. 0.0337/(0.1226 × 58) or 0.00474 moles per gram.

Since the consumption of periodate during the preparation of the sample was 0.00532 mole per gram, the recovery was 89% of theory.

Colorimetric Method

Aliquots of the first two fractions of distillate, each chosen to contain 4.7 to 15×10^{-4} moles of combined glyoxal, were diluted to 100 cc. with hydrochloric acid of such strength that the final acid concentration was $N/10$. The glyoxal was liberated by hydrolysis on the steam bath for 1 hour. A blue color was developed in 15-cc. aliquots of the hydrolyzed solutions by a slight modification of Ariyama's method *(1)* which consisted of adding 2 cc. of Benedict's uric acid reagent, 25 cc. of 0.25% sodium cyanide solution and an excess of solid sodium bicarbonate. The color was allowed to develop for 30 minutes before the solution was diluted to 100 cc. with water and the intensity was read with an Aminco neutral wedge photometer.

The color was translated into glyoxal concentration with the aid of a standardization curve made with accurately known amounts of pure glyoxal tetramethyl acetal *(8)*. An error of 2% was introduced directly by the observational error of about one scale division in an average photometer reading of 50 scale divisions. Another error arose by the failure of the color to develop exactly the same intensity with various samples of the same glyoxal solution. Although the intensity of color did not obey Beer's law, the intensity-glyoxal concentration plot was linear over the range used in the estimation. These factors reduced the over-all accuracy of the method to about 5%. Since the sum of the first two fractions of distillate contained 96.2% of all the tetramethyl acetal and since the 9.3% of cyclic acetal also present liberated about one quarter of the theoretical amount of glyoxal (estimated colorimetrically) after the 1 hour's hydrolysis, the photometer readings gave an approximate measure of all the glyoxal tetramethyl acetal.

The distillation technique corresponding to the data in Table I was employed after the methanolysis of a series of starches oxidized with 0.975, 0.78, 0.584, 0.391, and 0.195 moles of periodate at pH 4.2 and 25 deg. C. The recovery of the tetramethyl acetal, estimated by the above method, was 47.2, 45.2, 44.8, 48.3 and 48.4%, respectively, of theory.

An approximate estimate of the cyclic acetal was similarly made by ignoring the 3.8% of tetramethyl acetal in the third and fourth fractions of distillate. The technique was altered only by the substitution of an 18 hour's for the 1 hour's acid hydrolysis. With this more drastic treatment, the total of 46.3% of cyclic acetal present in the two fractions gave half of the theoretical glyoxal color.

Control Experiments

Estimation of the Glyoxal Acetals with 2, 4-Dinitrophenylhydrazine

Weighed samples of pure glyoxal tetramethyl acetal from glyoxal sulphate *(8)* and the pure cyclic acetal from a previous research *(16)* were separately dissolved in water. The solutions were acidified and hydrolyzed for 1 hour before being precipitated with the hydrazine as already described.

The quantitative recovery of the tetramethyl acetal confirmed earlier data *(8)*. Although the composi-

tion of the precipitate with the cyclic acetal was not determined, the weight (w_1) was always nearly 3.51

TABLE II.—RECOVERY OF THE DINITROPHENYLHYDRAZONES FROM THE GLYOXAL ACETALS

Tetramethyl Acetal,	Precipitate Found,	Precipitate Calcd.,	Recovery,	Wt. Ppt. / Wt. Acetal
mg	mg	mg	%	
20.5	56.9	57.2	99.5	...
20.5	56.6	57.9	99.2	...
19.6	54.0	54.5	99.2	...
20.5	57.9	57.2	101	...
Cyclic Acetal				
21.1	74.6	...	...	3.54
21.1	74.0	...	...	3.50
12.1	42.0	...	...	3.48
			Average	3.51

times the weight of acetal taken. Allowing for the change in molecular weight between the latter, 220, and glyoxal, 58, the glyoxal in the cyclic acetal was calculated to be $0.075w_1$.

Colorimetric Estimation of the Glyoxal Acetals

Known weights of pure tetramethyl acetal were dissolved in water and the solutions, after hydrolysis, contained 0.282, 0.212, 0.141, and 0.0705 mg. of glyoxal in 100 cc. After the development of Ariyama's blue color as already described, the photometer readings were proportional to 33.3, 34.0, 32.6, and 27.0 scale divisions, respectively, for 0.1 mg. of glyoxal. The photometerglyoxal plot was therefore linear over the concentration range of interest, although the line did not pass through the origin.

Samples, 4.82, 4.82, 4.58 mg., of the pure cyclic acetal were hydrolyzed on the steam bath for 18 hours before Ariyama's color was developed. Comparisons with the color of standard glyoxal solutions indicated the presence of 0.63, 0.63, and 0.62 mg. of glyoxal or 50, 50, and 52% of theory, respectively. A similar experiment in which the time of hydrolysis was only 1 hour gave an apparent glyoxal yield of 25%.

Recovery of the Acetals in the Standard Steam Distillation

Known weights of the pure tetramethyl and the cyclic acetals were separately dissolved in 52 cc. of methanol and the solution was diluted with 300 cc. of water containing 6.5 grams of sodium chloride and 1 gram of sodium hydroxide. The distillation was carried out as already described and the four successive volumes of distillate were analyzed for glyoxal by the 2, 4-dinitrophenylhydrazine method (*see* Fig. 4).

The rate of distillation of different sized samples was concordant to one part in 200 for the tetramethyl acetal and to about 3 parts in 100 for the

TABLE III.—STEAM DISTILLATION OF GLYOXAL ACETALS

Tetramethyl Acetal,	Fraction of Distillate,	Hydrazone Precipitate,	Acetal Recovered,	Total Recovery,
mg.	cc.	mg.	%	%
45.7	0—100	76.6	60.3	60.3
	100—200	45.2	35.6	95.8
	200—300	2.8	2.3	98.1
	300—400	0.0	0.0	98.1
91.4	0—100	153.8	60.5	60.5
	100—200	91.2	36.0	96.5
	200—300	4.4	1.7	98.2
	300—400	0.0	0.0	98.2
Cyclic Acetal				
76.4	0—100	5.4	2.0(a)	2.0
	100—200	18.4	6.9	8.9
	200—300	80.2	30.0	38.8
	300—400	41.6	15.9	54.7
107.8	0—100	8.8	2.3	2.3
	100—200	28.4	7.5	9.8
	200—300	119.4	31.6	41.5
	300—400	57.4	15.2	56.6

(a) Calculated by dividing the weight of the precipitate by the factor 3.5 (Table II).

cyclic acetal. The fifth column contains the data assumed in the analysis of a mixture of the two acetals in unknown proportions.

Stability of the Acetals Toward Methanolic Hydrogen Chloride

Pure samples were dissolved in 25-cc. volumes of methanol containing 2.5 grams of dry hydrogen chloride and the solutions were boiled under reflux for 18 hours. The solutions were made alkaline, diluted with water, and distilled as already described for an oxystarch. The recovery of the cyclic acetal, as such and as tetramethyl acetal, was estimated by the dinitrophenylhydrazine method. In the case of the tetramethyl acetal experiments, it was sufficient to combine the four fractions of distillate and analyze them colorimetrically.

TABLE IV.—RECOVERY OF THE GLYOXAL ACETALS FROM ACID METHANOL

Tetramethyl Acetal, mg.	Recovery T.m. acetal, %	Recovery Cyclic acetal, %	Total Recovery, %
10	98.3	..	98.3
10	98.3	..	98.3
10	101	..	101
16.1	97.3	..	97.3
Cyclic Acetal			
142.2	29	57	86
188.7(a)	28	59	87

(a) Refluxed in the acid methanol for 16 hours.

Glyoxal tetramethyl acetal was recovered unchanged in amount after methanolysis. The cyclic acetal was definitely unstable, about 29% being broken down to the tetramethyl acetal and about 14% of the glyoxal units being missing. It followed that the cyclic acetal found after the methanolysis of oxystarch or oxycellulose was probably only 58% of that originally formed. The tetramethyl acetal found was probably in excess of the original amount for a similar reason.

Results and Discussion

After the methanolysis of the periodate oxystarch or oxycellulose sample, and the steam distillation to give four fractions of distillate, the glyoxal tetramethyl acetal and the cyclic acetal (VIII) were separately estimated, as glyoxal, by independent 2, 4-dinitrophenylhydrazine and colorimetric methods. These two methods checked each other well (Table V) except in the case of the third plus fourth fractions of the distillate from oxycellulose. This discrepancy amounted to about 5% of the total recovery.

TABLE V.—COMPARISON OF PRECIPITATION AND COLORIMETRIC METHODS OF ANALYSIS

Oxystarch, mg.	Distillate Fraction(a)	Glyoxal from Hydrazone, mg.	Glyoxal Colorimetric, mg.
122.6	1 + 2	22.6	22.6
	3 + 4	5.6	5.8
Oxycellulose			
124.6	1 + 2	15.7	15.2
	3 + 4	6.2	4.6
139.0	1 + 2	17.4	17.7
	3 + 4	6.4	5.2

(a) In routine analyses it seems justifiable to collect the first and second fractions of distillate together and also the third and fourth.

Table VI shows that, when periodate oxystarches and oxycelluloses were prepared as described in the experimental portion, about 90% of the oxidant produced oxidation to Structure V, as estimated by the dinitrophenylhydrazine method.

Reference to Table IV, however, shows that these recoveries were minimum values, because 13 to 14% of the cyclic acetal was not recovered, as glyoxal, after methanolysis. Assuming that the data in Table IV applied during the methanolysis of the oxystarch,

TABLE VI.—ESTIMATION OF DIALDEHYDE CLEAVAGE IN PERIODATE OXYSTARCHES AND OXYCELLULOSES

Oxystarch, mg.	Periodate per gram, mole	Glyoxal recovered as T.m. acetal, %	Glyoxal recovered as Cyclic acetal, %	Total, %(a)
122.6	0.00532	58	31	89
124.6	0.00532	57	31	88
Oxycellulose				
124.6	0.00442	50	40	90
130.0	0.00470	52	46	98
139.0	0.00442	50	38	88
301.9	0.00234	44	40	84

(a) Calculated on moles periodate used in oxidation.

it can be calculated from Table VI that the original yield of the cyclic acetal was 53% and that of the tetramethyl acetal, 43%. The total recovery was therefore about 96 instead of 88 to 89% of theory from the periodate. A comparison between these values and the 90 to 95% of dialdehyde cleavage deduced for starch oxidized at pH 4.2 and 20 deg. C. (Figs. 1 and 3) gave very strong support to the validity both of the analytical method and to the interpretation put upon the shape of the oxidation rate plots. The shorter colorimetric method indicated uniform yields of 46.7 ± 1.5% of the tetramethyl acetal from starches oxidized with 0.20 to 0.98 moles of periodate per glucose residue. Twice this figure therefore gave a good approximation to the total amount of dialdehyde cleavage. The oxidation of cellulose by periodate proceeded almost as smoothly as in the case of starch (Table VI), although this fact could not have been predicted from the corresponding rate plot. (Fig. 3).

Some preliminary estimations were carried out on oxycelluloses prepared by potassium persulphate in presence of silver nitrate at pH 3.7 and 25 deg. C by acidic hypochlorite by acidic permanganate (15), by dilute nitric acid *(17)*, by dichromate at pH 1.1 and 25 deg. C and by alkaline hypobromite. The permanganate product gave traces of glyoxal which were too small to estimate quantitatively while all the other results were entirely negative. All are omitted from the experimental portion. Although these oxycelluloses contained no units of Structure V and therefore yielded no glyoxal when hydrolyzed with aqueous acid, the hydrolyzates frequently gave a deep blue coloration with the reagents of the glyoxal estimation. These reagents are therefore not entirely selective for glyoxal but the analytical procedure described effectively removed any interfering units originally present in the oxycelluloses. The observation that periodate oxycelluloses consist almost entirely of the Structure V, which is completely lacking in dichromate oxycelluloses, affords a convincing confirmation of the views of Davidson *(5)*. Davidson carried out the oxidations with closely parallel conditions and postulated a deep-seated difference in the chemical effects of dichromate and periodate. He then had a rational explanation of the striking difference in the behavior of the two products toward sodium bisulphite, methylene blue, alkali, and other reagents.

Although not of immediate importance for the technical estimation of the dialdehyde type of oxidation, the observations summarized in Tables VII and VIII are not without significance.

TABLE VII.—TIME OF METHANOLYSIS AND THE YIELD OF GLYOXAL TETRAMETHYL ACETAL

Oxystarch,(a) mg.	Refluxed,(b) hours	Glyoxal Calcd., mg.	Glyoxal Found,(c) mg.	Yield, %
121.8	3	37.6	21.2	57
121.0	6	37.4	23.9	64
125.1	18	38.6	23.8	60
122.0	25	37.6	22.5	58

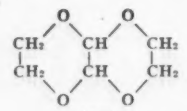
(a) Oxidized with 0.00532 moles of periodate per gram.
(b) The 25 cc. of methanol contained 2.5 grams of hydrogen chloride.
(c) As the tetramethyl acetal, corrected for cyclic acetal.

With periodate oxystarch, the yield of glyoxal tetramethyl acetal was independent of the time of methanolysis from 3 hours onward, provided that the concentration of hydrogen chloride was kept constant (Table VII). When the time of methanolysis was 16 to 18 hours and the acid content was varied above a certain minimum concentration, the yields of the tetramethyl and the cyclic acetal varied inversely in such a way that the total recovery retained its proper value of about 90% (Table VIII). It is therefore possible that one or more equilibria exist between methylerythroside, glyoxal tetramethyl acetal, and the cyclic acetal (Structures VI, VII, and VIII) and that the amount of the latter increases with the hydrogen chloride concentration. The system is complicated by the presence of the 9 and the 2.8% of water, which can be formed, together with methyl chloride, by refluxing methanol containing 24 and 10%, respectively, of hydrogen chloride *(4)*. It has been shown *(11, 18)* that cyclic acetals tend to be more stable toward acid hydrolysis than the similar open chain compounds. We have noted that 20% yields of 2, 3-ethylenedioxy dioxane (IX) are formed by heating glycol with glyoxal tetramethyl acetal dissolved in normal aqueous or aqueous alcoholic hydrogen chloride *(3)*.

TABLE VIII.—EFFECT OF HYDROGEN CHLORIDE CONCENTRATION DURING METHANOLYSIS

Oxystarch,(a) mg.	HCl in Methanol,(b) %	Tetramethyl Acetal, %	Cyclic Acetal, %	Total Recovery, %
123.3	26	48	40–45	88–93
122.6	10	59	31	90
120.5	0.8	34	19	53

(a) Oxidized with 0.00532 moles of periodate per gram.
(b) Refluxed for 16-18 hours in 25 cc. of methanol containing 6.5, 2.5, and 0.2 gram of hydrogen chloride.



IX

The cyclic acetal IX was therefore formed in conditions which appeared to be ideal for its hydrolysis.

Acknowledgment

The authors wish to thank the following organizations for the financial assistance which made it possible to complete the research: the Fundamental Research Committee of the Technical Association of the Pulp and Paper Industry, E. I. du Pont de Nemours and Company, the Hercules Powder Company, and the Mathieson Alkali Works.

Literature Cited

1. Ariyama, N., *J. Biol. Chem.* 77, 359 (1928).
2. Baird, D. K., Haworth, W. N., and Hirst, E. L., *J. Chem. Soc.* 1201 (1935).
3. Baker, W., and Field, F. B., *ibid.* 86 (1932).
4. Carter, S. R., and Megson, N. J. L., *J. Soc. Chem. Ind.* 46, T31 (1927).
5. Davidson, G. F., *J. Text. Inst.* 31, T81 (1940); 32, T109 (1941).
6. Doree, C., "The Methods of Cellulose Chemistry" New York. 1933. pp. 112-143.
7. Fleury, P., and Lange, J., *J. chim. et pharm.* 27, 196 (1933).
8. Grangaard, D. H., and Purves, C. B., *J. Am. Chem. Soc.* 61, 428, 755 (1939).
9. Grangaard, D. H., Michell, J. H., and Purves, C. B., *ibid.* 61, 1290 (1939).
10. Harris, C. A., and Purves, C. B., *Paper Trade J.* 110, 6:29-33 (Feb. 8, 1940).
11. Hibbert, H., and Hill, H. S., *J. Am. Chem. Soc.* 45, 734 (1923).
12. Hibbert, H. and Parsons, J. L., *J. Soc. Chem. Ind.* 44:473 (1925). *See* also Heuser, E. and Stockigt, F., *Cellulosechem.* 3:61 (1922), and Clifford, P. H. and Fargher, R. G., *J. Text. Inst.* 13:189T (1922).
13. Jackson, E. L., and Hudson, C. S., *J. Am. Chem. Soc.* 59, 2049 (1937); 60, 989 (1938).
14. Kaswell, E. R., Mass. Inst. Tech. M.Sc. Thesis, Course IIG. June, 1940.
15. Knecht, E., and Thompson, L., *J. Soc. Dyers Col.* 36, 251 (1920).
16. Michell, J. H., and Purves, C. B., *J. Am. Chem. Soc.* (1942).
17. Nastukoff, A., *Ber.* 34, 3589 (1901).
18. Verley, A., *Bull. soc. chim.*, [3], 22, 275 (1899).
19. Witz, G., *Bull. Rouen.*, 10, 450 (1882); 11, 177 (1883).

Beat Down Foam with SPRACO NOZZLES

FOR beating down foam in head boxes this Spraco direct pressure nozzle will produce a hollow cone spray of uniform distribution over the area covered. Other Spraco nozzles producing a full cone or flat fan-shaped spray can be used for the same purpose depending upon the particular requirements. Spraco nozzles are available from stock in a wide range of sizes and capacities in brass, bronze, cast iron, and steel.

Write for Nozzle Catalog.

SPRAY ENGINEERING CO.

118 Central St., Somerville, Mass.

ZOPAQUE RG

Pure TiO_2

This grade of TiO_2 shows highest developments of aqueous dispersion and suspension yet attained.

As our Company now operates under P.R.P. we will appreciate it and can serve you better if each of your orders carry the proper Symbol Number.

Sole Selling Agents:

The Chemical & Pigment Company

Baltimore, Md. · Collinsville, Ill. · Oakland, Calif.

Manufactured by

American Zirconium Corporation

Baltimore, Maryland

At Your Service...

You are invited to use Our Technical Service on

STARCHES

GUMS

SYRUPS

DEXTRINES

•

STARCH
FOR ENZYME CONVERSION

AMIJEL
FOR THE BEATERS

LAM-O-DEX
FOR LAMINATING

CORAGUM
FOR CORRUGATING

WRITE...

Corn Products Sales Co.
17 BATTERY PLACE
NEW YORK CITY

IMPORTS OF PAPER

NEW YORK IMPORTS

WEEK ENDING AUGUST 8, 1942

SUMMARY

Newsprint ..... 2,831 rolls

NEWSPRINT

——, ——, ——, 390 rolls.
N. Y. Evening Journal, ——, ——, 212 rolls.
Brooklyn Daily Eagle, ——, ——, 368 rolls.
N. Y. Tribune, ——, ——, 1229 rolls.
World Telegram, ——, ——, 632 rolls.

BONES

——, ——, ——, 15433 bags.

PHILADELPHIA IMPORTS

WEEK ENDING AUGUST 8, 1942

Paper Makers Importing Co., ——, ——, 615 tons china clay.
Moore & Munger, ——, ——, 148 tons china clay.
China Clay Sales Corp., ——, ——, 1127 tons china clay.
J. W. Higman Co., ——, ——, 398 tons china clay.

P.T.A. to Hold Special Meeting

[FROM OUR REGULAR CORRESPONDENT]

PHILADELPHIA, Pa., August 10, 1942—Announcement is made by Ross W. Fishburn, of Whiting-Patterson Co., Inc., and secretary of the Paper Trade Association of Philadelphia, that a special meeting of the association will be held in Room 631 Drexel Building, on Thursday, August 13, at 1:30 P.M., when Bob Ziegler of the National Association will address the members on the paper situation as it relates to Washington.

There is No Paper Shortage

In the endeavor to do everything possible to correct the impression that there is a paper shortage Charles E. Carey, executive vice president of the Central Fiber Products Company, 111 West Washington street, Chicago, recently proposed the following statement which was given to all employees with their pay checks and sent to all stockholders with their dividend payments:—

"You have read and been told that there is a shortage of paper—boxes, containers, bags, etc.—all forms and grades. This widespread appeal to save paper was started from the Government's appeal to the public to save *waste paper* in order to avoid a shortage of the finished paper products.

"Waste paper is now being saved in sufficient quantities to permit mills to run full with a capacity large enough to supply all war and civilian needs, but because some manufacturers, jobbers, and merchants everywhere saw an opportunity to twist the meaning of the Government's appeal and turn it to their own selfish benefits, mills are reduced to part time operation, there is no outlet for the accumulations of waste paper, thousands of men are thrown out of work, breakage of merchandise due to improper packaging is increasing rapidly, and health and sanitation throughout the nation are threatened.

"There is no shortage of paper or paper articles, and a patriotic duty will be filled by insisting upon proper packaging of all purchases. Accept no purchase not properly wrapped and boxed in new materials. Do not accept used, unsanitary, wasteful packaging materials.

"This nation is at war, and two of the most vital elements in winning that war are:

"1. Guarding the health of the entire population.

"2. Avoiding breakage and waste of critical and valuable merchandise and material.

"Insist upon proper packaging in new materials."

Amends Mimeograph Classification

WASHINGTON, D. C., August 12, 1942—In a technical amendment to Limitation Order L-120, which establishes manufacturing specifications for many types of paper, the WPB Director General of Operations has added a weight classification to the specifications for chemical wood pulp mimeograph paper in order to meet requirements of the armed forces and Federal, State and municipal agencies.

Under the original order, this type of mimeograph paper was permitted to be manufactured only in substance weights 16 and 20. Later, it was found that an intermediate weight, substance weight 18, was in use generally by Federal, State and municipal agencies. In order to avoid forcing these agencies to turn to a heavier weight and thus increase the use of paper, the intermediate weight (18) has been added to the specifications by Amendment No. 1 to Schedule III (covering fine writing papers) of the order.

Issues Chemical Trade Catalogue

The Monsanto Chemical Company, 1700 South Second street, St. Louis, Mo., has just issued a new 170-page 26th edition of Monsanto Chemicals.

The publication, conveniently arranged and plastic-ring bound, contains chemical names, trade names, formulas, standard forms or grades, uses and general information. It also includes available special literature on all of the several hundred chemicals and plastics manufactured by the company. A technical section includes tables of physical constants for some of the more common chemicals.

Paper Box Orders Off in July

CHICAGO, Ill., August 10, 1942—Orders booked by members of the Folding Paper Box Association of America in July were only 61.2 per cent of the total a year earlier, preliminary data indicated today. July bookings were 90.8 per cent of those for June of this year. A part of the decline was attributed to the economies still practiced by most stores in packaging merchandise for delivery, despite the fact that, temporary at least, the boxboard shortage is over.

Norman Scott With WPB

[FROM OUR REGULAR CORRESPONDENT]

BOSTON, Mass., August 10, 1942—Norman Scott, formerly sales representative for W. C. Hamilton & Sons, Inc., and for a considerable period previously with the Deerfield Glassine Company, is now analyst with the Paper and Pulp Division of the War Production Board, with offices at 17 Court street, Boston. Mr. Scott is well known in the trade.

Cleaner Water For a Better Sheet

NORWOOD FILTERS Will Give You Cleaner Water . . . And Stand Up For Years of Dependable Service

The Norwood Filters at Fox River's Telulah Mill were installed nearly a quarter of a century ago. Still giving dependable service.

YOU can depend on Norwood Filters to give you better, cleaner process water to help you keep up the quality of your sheet, and you can depend on Norwood Filters to give you years of satisfactory, trouble-free service. Norwood has been working with paper mill men to lick their process water troubles for nearly half a century. Norwood Filters have been developed and improved through this long period of whole-hearted cooperation. If you have a problem involving your process water, take it up with Norwood.

Send For Engineering Data Units. We'll gladly send you a set of Engineering Data Units covering Norwood Filters, upon request.

Get a Good Start And a Good Finish With
NORWOOD
WATER FILTERS AND PAPER FINISHING MACHINERY

The Norwood Engineering Company
17 No. Maple St., Florence, Mass.

Carries nearly FULL LOAD EVEN WHEN DAMP!

- LAPS AND PLYS STAY CEMENTED
- RESISTS HEAT UP TO 170°F.
- GETS MORE OUTPUT FROM PRESENT MACHINES

TANNATE flat leather belts keep machines running at peak efficiency, without trouble, with very little maintenance. They carry practically full load, even when damp . . . are cemented with waterproof cement and treated to resist moisture. Says one user: "Our TANNATE belts have needed shortening only once in 16 years . . . operating in dampness and temperatures up to 105°F. the year around".

Writing about a TANNATE belt on a wood chipper that has run about 14 years, the user reports a 33-1/3% increase in output and much lower chipping cost!

TANNATE may mean increased output and reduced cost for you too! Try it!

STEP UP PRODUCTION with
RHOADS
Established 1702
Tannate
WATERSHED LEATHER BELTING

J. E. RHOADS & Sons, 35 N. Sixth St., Phila, Pa.
NEW YORK • CHICAGO • ATLANTA • CLEVELAND • Factory and Tannery, Wilmington, Delaware

New York Paper and Pulp Market Review

Quietness Prevails In Paper and Pulp Markets With Prospects For Future Uncertain—Rag Market Slow—Demand For Paper Stock Light — New Jute Twine Conservation Order Is Now In Effect.

Office of the PAPER TRADE JOURNAL,
Wednesday, August 12, 1942.

Sales volume in the wholesale paper market has declined to a level comparable to the low point reached in June, 1939, which is about 20% below the average for last year at this date. Reports received this week from many manufacturers' representatives, jobbers, and general paper merchants, reflect concern regarding business prospects for the future. A lower production ratio for paper mills is generally expected. Demand for all grades of paper, including paper board, is currently reported at a relatively low level. Prices in some lines are less firm.

The index of general business activity for the week ended August 1, rose to 133.0%, from 131.8% for the preceding week, compared with 131.9% for the corresponding week last year. Paper board production was 4.8% higher.

Paper production for the week ended August 1 was estimated at 79.8%, compared with 100.5% for 1941, with 88.8% for 1940, with 80.5% for 1939, and with 73.2% for the corresponding week for 1938.

Paper board production for the week ended August 1 was 76.0%, compared with 93.0% for 1941, with 74.0% for 1940, with 70.0% for 1939, and with 64.0% for the corresponding week for 1938.

An excellent chart explanation of WPB Priorities Regulation No. 10, has been issued by the American Paper and Pulp Association. Examples are worked through to provide a clear understanding of the government's requirements, thus furnishing a practical guide for manufacturers, jobbers, and general paper merchants.

The newsprint price is well stabilized at $50 per ton. The OPA has issued a list classifying all the counties in the U. S. according to the established zones. This list does not change the ten price zones established by Maximum Price Regulation No. 130, but provides a method for publishers and printers, with plants in zone-boundary areas, to readily determine the zone in which they are located.

Wood Pulp

The chemical wood pulp supply situation has become easier with the decline in paper production. No important change in prices or demand has been reported during the current week.

Rags

Trading in domestic rags is slow at this date. Mill buying of new cotton cuttings is light. Demand for the roofing grades has declined to a level where the market situation is reported as quiet. Prices are unchanged.

Demand for other grades of rags is slow with no important change in prices reported at this date

Old Rope and Bagging

Good demand continues in old Manila rope. Ceiling prices are reported as being quite well maintained.

Trading in scrap bagging is light. Prices are less firm but generally reported as unchanged.

Old Waste Paper

Although collections of old waste paper continue to be reported as limited, mill buying is also light and not much change in this market has occurred this week. Trading is at well below ceiling prices, with some improvement in old corrugated. Mixed and the news grades are weak.

Twine

The WPB Jute Conservation Order M-70, effective July 31, permits manufacturers to produce for civilian use, in the month of August, 30% of the average monthly shipments for 1941. Jute twines and cordage for agricultural uses are not subject to this percentage ruling, but orders must carry certification of use for agricultural and allied uses.

Floods Hamper Paper Mills

PHILADELPHIA, Pa., August 10, 1942 — Floods struck a four-county area of southeastern Pennsylvania during the week-end, damaging highways and spreading destruction through hundreds of homes and across the countryside. Creeks in Chester, Bucks, Montgomery and Lancaster counties swelled by recent rains ran rampant. Historic Brandwine Creek, which ran red in the American Revolution, roared into industrial plants at Coatesville, causing an unestimated amount of damage. Two miles downstream, at Paperville, two floors of the Beach & Arthur Paper Co's. mill were under water, and residents had to flee from their submerged homes. The stream's east branch and Beaver Creek at Downingtown, five miles east of Coatesville, also overflowed, causing extensive damage to a paper mill there.

H. A. Harvey Made 2nd Lieutenant

Harold A. Harvey who has been connected with the Bulk Sales Department of Penick & Ford, Ltd., Inc., New York, for the past six years, has been commissioned as a First Lieutenant in the Army Air Force and has reported at Miami Beach, Fla., for induction, after which he will be sent to the 4th Air Force at Hamilton Field, California.

DIVERSION OF MANPOWER

(Continued from page 9)

upon the pulpwood operations for a considerable portion of their income, are not subject to the manpower regulations and can be depended upon for a regular supply of pulpwood. However, those operators who have recruited their own crews in former years, will experience difficulty in getting sufficient men and will have to depend more on the labor of settlers in the immediate neighborhood of operations.

In any event, it is not believed that the call for men by the armed services and war industries nor the diversion of power will prevent all demands for pulp and newsprint being met by Canadian mills.

High Production Calls For

MODERN MACHINES

Toilet Tissue Intefolders

4 Color Printing Press handling 60" web.

Napkin folder equipped with Embossing, Printing, and folding.

The above machines represent only a few of our varied line. Write us regarding your requirements for paper converting machinery.

PAPER CONVERTING MACHINE CO. Green Bay, Wis.

FIBRE MAKING PROCESSES, INC.

435 N. Michigan Ave., Chicago

U-Bar Barking & Washing Drum
Orrmell Log Barker
Waplan Bark Press
Nekoosa Chip Cutter
F.M.P. Circ. & Ind. Heating System
Coolidge Chip Packer
F.M.P. Coarse Screen & Knotter
Blow Steam Plants
Thune Pressure Filter
Norman Chip Duster
Drammen Blow Valve
Sandberg Diffuser Valve

Ti-Machine Doctor Blades

Over one hundred mills in all parts of the country come to us regularly for their Doctor Blades. The list is growing steadily because both blades and service are good.

The bulk of the orders are for Ti-Machine steel blades but a substantial proportion specify stainless steel, bronze and plastic material.

Special equipment is used and trained men turn out the blades. Machining is not a difficult operation, but straightening steel blades in such a manner that they will be relieved of strains and stresses is a manual operation amounting to an art.

If you are not already receiving your Doctor Blades from us, will you not send us your next inquiry and try them out?

Montague Machine Company

Turners Falls, Mass.

MISCELLANEOUS MARKETS

Office of the PAPER TRADE JOURNAL,
Wednesday, August 12, 1942.

BLANC FIXE—Quotations on blanc fixe are firm and continue unchanged at prevailing market levels. The pulp is currently quoted at $40 per ton in barrels, at works; the powder is offered at $60 per ton, f.o.b., works, Demand reported fair for the week.

BLEACHING POWDER—Prices on bleaching powder are firm. Supply under allocation control. Bleaching powder is currently quoted at $2.25 per 100 pounds, in drums, at works.

CASEIN—Quotations on casein are higher for the week. Standard domestic casein, 20-30 mesh, is currently quoted at 15 cents per pound; 80-100 mesh at 15½ cents per pound; all prices in bags, car lots. Standard Argentine casein is currently offered at 10 cents per pound, c.i.f. No quotations on French casein.

CAUSTIC SODA—Prices of caustic soda are reported unchanged. Supplies ample. Demand moderate for the current week. Solid caustic soda is currently quoted at $2.30 per 100 pounds, flake and ground at $2.70 per 100 pounds, in drums, at works.

CHINA CLAY—Quotations on china clay are firm and continue unchanged. Demand reported fair for the current week. Domestic filler clay is currently quoted at from $7.50 to $15 per ton; coating clay is quoted at from $12 to $22 per ton, at mines. Imported clay is quoted at from $13 to $25 per long ton, ship side.

CHLORINE—Quotations on chlorine unchanged. Government demand for war use continues very heavy. Chlorine is currently quoted at from $1.75 per 100 pounds, in single-unit tank cars, f.o.b., works.

ROSIN—Quotations on some grades of rosin are lower for the current week. "G" gum rosin is currently quoted at $2.93 per 100 pounds, in barrels, Savannah. "FF" wood rosin is currently quoted at $2.93 per 100 pounds in barrels, New York. Seventy per cent gum rosin size is quoted at $3.29 per 100 pounds, f.o.b., works.

SALT CAKE—Prices on salt cake are firm. Demand reported fair for the current week. Domestic salt cake is currently quoted at $15 per ton in bulk; chrome salt cake at $16 per ton. All prices in car lots, f.o.b., shipping point. Quotations on imported salt cake are nominal at $16 per ton.

SODA ASH—Quotations on soda ash are less firm and continue to conform to prevailing market quotations. Demand moderate. Quotations on soda ash in car lots, per 100 pounds, are as follows: in bulk, $.90; in paper bags, $1.05; and in barrels, $1.35.

STARCH—Prices on corn starch continue unchanged for the current week. Pearl is currently quoted at $3.10 per 100 pounds; powdered starch at $3.20 per 100 pounds; all prices in bags, car lots, f.o.b., Chicago.

SULPHATE OF ALUMINA—Quotations on sulphate of alumina are firm. Demand reported fair. The commercial grades are currently quoted at $1.15 per 100 pounds; iron free at from $1.75 to $1.85 per 100 pounds, in bags, car lots, f.o.b., works.

SULPHUR—Prices of sulphur are firm and continue to conform to prevailing market quotations. Annual contracts are currently quoted at $16 per long ton, f.o.b., mines. Spot and nearby car lots are quoted at $18 per ton.

TALC—Quotations on talc are firm and continue unchanged at prevailing market prices. Domestic talc is currently quoted at from $16 to $21 per ton, at mills. No quotations on imported talc.

MARKET QUOTATIONS

All market quotations, excepting those otherwise designated as official OPA maximum prices, are based on the manufacturers' price level as of October 1-15, 1941; maximum wholesale prices are based on the merchants' maximum prices for stipulated quantities at a quoted price to all customers of a like class, as shown by the merchant's sales records of goods delivered during March, 1942. A merchant's price list in effect in March 1942, showing quotations of actual shipments, will establish the current maximum prices.

Paper

(Delivered New York)

News, per ton—			
Roll, contract	$50.00	@	—
Sheets	58.00	"	—
Kraft—per cwt.—Carload Quantities Zone A, f.o.b. Mill			
Superstandard Wrapping	$5.00	@	—
No. 1 Wrapping	4.75	"	—
Standard Wrapping	4.50	"	—
Standard Bag	4.125	"	—
Tissues—Per Ream—Carlots			
White No. 1	1.12½	"	—
White No. 1 M. G.	1.05	"	—
White No. 1½	1.00	"	—
White No. 2	1.00	"	—
Anti-Tarnish M. G.	.95	"	—
Colored	—	"	—
Kraft	.95	"	—
Manila	.98	"	—
Unbl. Toilet, 1 M.	4.16	"	—
Bleached Toilet	5.70	"	—
Paper Towels, Per Case—			
Unbleached, Jr.	2.35	"	—
Bleached, Jr.	2.65	"	—
Manila—per cwt.—C. l. l. a.			
No. 1 Jute	11.25	@	—
No. 1 Manila Wrapping, 35 lb.	5.50	"	5.75
No. 2 Manila Wrapping, 35 lb.	5.25	"	5.50
Boards, per ton—			
News	*48.00	@	—
Chip	*45.00	"	—
Sgl. Mla. Lt. Chip	*60.00	"	—
White Pat. Coated	*75.00	"	—
Kraft Liners 50 lb.	*60.00	"	—
Binders Boards	84.00	"	116.00

* OPA Base Prices per 10 tons. Less than 10 tons but over 3 tons, add $2.50; three tons or less, add $5; regular 35-39 basis, add $5.; basis 40-49, add $2.50; basis 91-100, add $2.50; basis 101-120, add $5.

The following are representative of distributors' resale prices:

Rag Content Bonds and Ledgers—White, Assorted Items, Delivered in Zone 1:

	Bonds	Ledgers
100% Rag Ext. No. 1	$40.25@$47.25	$41.40@$48.50
100% Rag	32.20 " 37.75	33.35 " 39.25
85% Rag	.... "	32.20 " 37.75
75% Rag	24.75 " 29.00	25.90 " 30.50
65% Rag	.... "	22.80 " 27.75
50% Rag	18.70 " 22.75	19.90 " 24.25
25% Rag	16.40 " 20.00	17.55 " 21.50

Colors at $1.00 cwt. extra.

Sulphite Bonds and Ledgers—White, Assorted Items. Delivered in Zone 1:

	Bonds	Ledgers
No. 1	$10.55@$12.75	$11.70@$14.25
No. 2	9.65 " 11.75	10.80 " 13.25
No. 3	9.20 " 11.25	10.35 " 12.50
No. 4	8.90 " 10.75	10.05 " 12.25

Colors $1.00 cwt. extra.

Free Sheet Book Papers—White, Cased Paper.

Delivered in Zone 1:

No. 1 Glossy Coated	$13.65@$15.50
No. 2 Glossy Coated	12.40 " 14.00
No. 3 Glossy Coated	11.60 " 13.25
No. 4 Glossy Coated	11.15 " 12.75
No. 1 Antique (watermarked)	10.25 " 11.75
No. 2 Offset	9.60 " 11.00
A Grade E. F.	9.35 " 10.75
A Grade S. & S. C.	9.60 " 11.00
B Grade E. F.	8.85 " 10.25
B Grade S. & S. C.	9.10 " 10.50
C Grade E. F.	8.55 " 9.75
C Grade S. & S. C.	8.80 " 10.00
D Grade E. F.	8.25 " 9.50
D Grade S. & S. C.	8.50 " 9.75

Ivory & India at $.50 cwt. extra.

Wood Pulp

OPA Maximum Prices and Canadian Manufacturers Prices, Less Freight to Destination.

Bl. Softwood Sulphite	$76.00
Unbl. Softwood Sulphite	64.00@ 66.00
Bl. Hardwood Sulphite	73.50
Unbl. Hardwood Sulphite	63.50
Bl. Mitscherlich	81.00
Unbl. Mitscherlich	72.00
N. Bleached Sulphate	86.00
S. Bleached Sulphate	79.00
N. Semi-Bleached Sulphate	62.00
S. Semi-Bleached Sulphate	75.00
N. Unbl. Sulphate	73.00
S. Unbl. Sulphate	63.50
Bl. Soda	66.00
Unbl. Soda	62.00
Groundwood	46.00

Transportation Allowances Applying to Producers of Wet Wood Pulp.

	Below 50% Air Dry Weight
Northeast	$13.50
Lake Central	13.50
Southern	16.00
West Coast (in area)	10.50
West Coast (out area)	16.50
	50%-80% Air Dry Weight
Northeast	$11.50
Lake Central	11.50
Southern	14.00
West Coast (in area)	9.50
West Coast (out area)	15.50

Applying to Producers of Dry Wood Pulp.

	Above 80% Air Dry Weight
Northeast	$8.50
Lake Central	8.50
Southern	11.00
West Coast (in area)	7.50
West Coast (out area)	13.50

Should freight charges actually exceed these allowances, the difference may be added to the maximum price.

Domestic Rags

New Rags

(Prices to Mill f. o. b. N. Y.)

Shirt Cuttings—			
New White, No. 1.	8.00	@	8.25
Silesias No. 1	4.50	"	4.75
New Unbleached	8.00	"	8.25
Blue Overall	5.75	"	6.00
Fancy	3.00	"	3.25
Washables	2.50	"	2.75
Mixed Khaki Cuttings	2.50	"	2.75
O. D. Khaki Cuttings	3.00	"	3.15

PARIS II *Black*

WETS EASILY

FREEDOM from oiliness and coarse agglomerates are the reasons why PARIS II Black is particularly easy to disperse. Even distribution and uniform color result from the ultra-microscopic fineness of its particles.

Use PARIS II Black in your black and gray paper stocks with assurance of:

HIGHEST TINCTORIAL STRENGTH

•

EXCEPTIONAL UNIFORMITY

•

EASE OF HANDLING

•

Compressed or Semi-Compressed for Jet Black Papers

Uncompressed for Tinting Gray Stocks

A COLUMBIAN COLLOID

We invite technical inquiry

COLUMBIAN CARBON CO. • BINNEY & SMITH CO.

MANUFACTURER DISTRIBUTOR

41 East 42nd St., New York, N. Y.

TWO VALUABLE AIDS FOR THE PAPER MANUFACTURER

•

K-121-B DEINKING— DECOLORIZING

K-121-B is being used by paper manufacturers for various purposes. Because of its wetting and penetrating powers, this chemical lends itself to diversified uses. It is used with Lime and Caustic for decolorizing rag stocks. It prevents excessive redepositing of dye, or color, and by its buffer action, prevents degradation of fiber. The treated, or cooked stock washes out more readily. The bleach demand is reduced.

K-121-B has aided paper manufacturers in their deinking processes. Its ability to hold in suspension the pigments removed by alkalies insures a cleaner stock. Its penetrating qualities make the alkalies more effective in their work of ink removal.

K-140

When K-121-B is used on papers containing 3% or less ground wood, it will, in many instances, eliminate the need for bleach.

K-140 is especially designed for use in deinking ground wood paper stock. K-140 used in connection with caustic prevents yellowing and the finished pulp approximates the color of new ground wood.

•

THE KINSLEY CHEMICAL COMPANY

12500 Berea Road

CLEVELAND, OHIO

Old Rags

White, No. 1—			
Repacked	*3.80	"	—
Miscellaneous	*3.20	"	—
White, No. 2—			
Repacked	*2.90	"	—
Miscellaneous	*2.65	"	—
Third and Blues—			
Repacked	*2.20	"	—
Miscellaneous	*1.80	"	—
Roofing Rags—			
No. 1	*1.55	"	—
No. 2	*1.45	"	—
No. 3 (bagging)	*1.35	"	—
No. 4	*1.35	"	—
No. 5A	*1.35	"	—
Old Manila Rope	5.75	"	—

*OPA Maximum Prices.

Foreign Rags

All prices nominal

New Rags			
New Dark Cuttings	2.25	@	2.40
New Mixed Cuttings	2.00	"	2.20
New Light Silesias	5.50	"	5.75
Light Flannelettes	5.50	"	5.75
New White Cuttings	7.00	"	7.50
New Light Oxfords	4.00	"	4.50
New Light Prints	3.00	"	3.25
Old Rags			
No. 1 White Linens	7.50	"	8.50
No. 2 White Linens	6.50	"	7.50
No. 3 White Linens	4.50	"	—
No. 4 White Linens	2.25	"	3.25
No. 1 White Cotton	4.25	"	4.75
No. 2 White Cotton	3.25	"	3.75
No. 3 White Cotton	2.50	"	3.00
No. 4 White Cotton	1.90	"	2.20
Extra Light Prints	2.00	"	2.40
Ord. Light Prints	1.75	"	2.15
Med. Light Prints	1.55	"	1.95
Dutch Blue Cottons	2.25	"	2.50
French Blue Linens	3.00	"	—
Checks and Blues	2.00	"	—
Linsey Garments	1.90	"	2.00
Dark Cottons	1.50	"	1.60
Old Shopperies	1.30	"	1.45
New Shopperies	1.45	"	1.50
French Blues	2.25	"	2.50

BAGGING

(Prices to Mill, f. o. b. N. Y.)

Gunny No. 1—			
Foreign	Nominal		
Domestic	4.00	@	4.25
Wool Tares, light	4.25	"	4.50
Wool Tares heavy	4.50	"	4.75
Bright Bagging	4.50	"	4.85
Manila Rope—			
Foreign	—	"	—
Domestic	*5.75	"	—
Jute Threads	4.25	"	4.75
Sisal Strings	3.25	"	3.75
Mixed Strings	1.10	"	1.20

*OPA Maximum Price.

Old Waste Papers

(F. o. b. New York)

OPA Maximum Prices

No. 1 Hard White Envelope Cuts, one cut	3.37½	@	—
No. 1 Hard White Envelope Cuts	3.12½	"	—
No. 1 Hard White Shavings, unruled	2.87½	"	—
No. 1 Hard White Shavings, ruled	2.50	"	—
Soft White Shavings, one cut	2.87½	"	—
No. 1 Soft White Shavings	2.50	"	—
Soft White Shavings, Misc.	2.15	"	—
No. 1 Fly Leaf Shavings	1.67½	"	—
No. 2 Fly Leaf Shavings	1.12½	"	—
No. 1 Groundwood Fly Leaf Shavings	1.25	"	—
No. 2 Mixed Groundwood Fly Leaf Shavings	.90	"	—
Mixed Colored Shavings	.75	"	—
Mixed Groundwood Colored Shavings	.90	"	—
Overissue Magazines	1.67½	"	—
No. 1 Heavy Books & Magazines	1.57	"	—
Mixed Books	1.07½	"	—
No. 1 White Ledger	2.17½	"	—
No. 2 Mixed Ledger, colored	1.87½	"	—
New Manila Envelope Cuttings, one cut	2.87½	"	—
New Manila Envelope Cuttings	2.65	"	—
Extra Manilas	1.85	"	—
Mixed Kraft, Env. & Bag Cuttings	2.75	"	—
Kraft Envelope Cuttings	3.25	"	—
Triple Sorted, No. 1 Brown Soft Kraft	2.50	"	—
New 100% Kraft Corrugated Cuttings	2.25	"	—
No. 1 Assorted Old Kraft	1.75	"	—
New Jute Corrugated Cuttings	1.75	"	—
Old Corrugated Containers	1.00	"	—
Box Board Cuttings	.72½	"	—
White Blank News	1.65	"	—
Overissue News	.85	"	—
No. 1 News	.75	"	—
No. 1 Mixed Paper	.70	"	—

Twines

(F. o. b. Mill)

(Soft Fiber)

Coarse Polished—			
India	.21	@	—
White Hemp	.21	"	—
Fine Polished—			
Fine India	.26	"	—
Unpolished—			
Box	.17½	"	—
Paper Makers	.17	"	—
Tube Rope	.19	"	—
Wall Paper	.20½	"	—
Wrapping	.23	"	—
Soft Fiber Rope	.19	"	—
Cotton	.25	"	—
(Hard Fiber)			
Medium Java	.18	"	—
Mex. Sisal	.16	"	—
Manila	—	"	—

PHILADELPHIA

Domestic Rags (New)

(Price to Mill, f. o. b. Phila.)

Shirt Cuttings—			
New White No. 1	.07¼	@	.07½
New White No. 2	.04½	"	.05
Light Silesias	.04½	"	.04¾
Silesias, No. 1	.04	"	.04¼
Black Silesias, soft	.03¾	"	.04
New Unbleached	.07¼	"	.07½
Washable Prints	.03¾	"	.03½
Washable No. 1	.02	"	.02¼
Blue Overall	.04½	"	.05½
Cottons—According to grades—			
Washable shredding	—	"	.01¾
Fancy Percales	.03¼	"	.03½
New Black Soft	.02¾	"	.03
New Dark Seconds	1.75	"	2.00
Khaki Cuttings—			
No. 1 O. D.	.03	"	.03¼
No. 2 Mixed	.02¼	"	.02½
Corduroy	.01¾	"	.02¼
New Canvas	.04¾	"	.05¼
New Black Mixed	—	"	.02½

Domestic Rags (Old)

White No. 1—Repacked	3.80	"	—
White No. 2—Repacked	2.90	"	—
Miscellaneous No. 1	3.20	"	—
Miscellaneous No. 2	2.65	"	—
Thirds and Blues—			
Miscellaneous	1.80	"	—
Repacked	2.20	"	—
Black Stockings—			
(Export)	Nominal		
Roofing Stock—			
Foreign No. 1	Nominal		
Domestic No. 1	1.55	"	—
Domestic No. 2	1.45	"	—
Roofing Bagging	1.35	"	—
Old Manila Rope	5.75	"	—

Bagging

(F. o. b. Phila.)

Gunny No. 1—			
Foreign	Nominal		
Domestic	3.00	"	3.50
Sisal Rope	3.75	"	—
Mixed Rope	.75	"	1.00
Scrap—			
No. 1	3.25	"	3.50
No. 2	1.75	"	1.80
Wool Tares, heavy	4.00	"	4.25
No. 1 New Light Burlap	3.00	"	4.00
New Burlap Cuttings	3.75	"	4.00

Old Papers

(F. o. b. Phila.)

OPA Maximum Prices

No. 1 Hard White Envelope Cuts, one cut	3.37½	"	—
No. 1 Hard White Shavings, unruled	2.50	"	—
Soft White Shavings, one cut	2.87½	"	—
White Blank News	1.65	"	—
Soft White Shavings, Misc.	2.15	"	—
No. 1 White Ledger	2.17½	"	—
No. 2 Ledger, colored	1.87½	"	—
No. 1 Heavy Books & Magazines	1.57	"	—
Overissue Magazines	1.67½	"	—
New Manila Envelope Cuttings	2.65	"	—
No. 1 Assorted Old Kraft	1.75	"	—
No. 1 Mixed Paper	.70	"	—
Box Board Cuttings	.72½	"	—
Jute Corrugated Cuttings	.90	"	—
Overissue News	.85	"	—
No. 1 News	1.00	"	—

BOSTON

Old Papers

(F. o. b. Boston)

OPA Maximum Prices

No. 1 Hard White Shavings, unruled	2.87½	@	—
No. 1 Hard White Shavings, ruled	2.50	"	—
Soft White Shavings, Misc.	2.15	"	—
No. 1 Fly Leaf Shavings	1.67½	"	—
No. 2 Fly Leaf Shavings	1.12½	"	—
No. 1 Groundwood Fly Leaf Shavings	1.25	"	—
No. 2 Groundwood Fly Leaf Shavings	.90	"	—
Mixed Colored Shavings	.75	"	—
New Manila Envelope Cuts, one cut	2.87½	"	—
Hard White Envelope Cuts, one cut	3.37½	"	—
Triple Sorted No. 1 Brown Soft Kraft	2.50	"	—
Mixed Kraft Env. & Bag Cuttings	2.75	"	—
Kraft Envelope Cuttings	3.25	"	—
No. 1 Heavy Books & Magazines	1.57	"	—
New Manila Envelope Cuts, one cut	2.87½	"	—
New Manila Envelope Cuttings	2.65	"	—
White Blank News	1.65	"	—
No. 1 Assorted Old Kraft	1.75	"	—
No. 1 Mixed Paper	.70	"	—
Overissue News	.85	"	—
Box Board Cuttings	.72½	"	—
New Corrugated Cuttings, Kraft	2.25	"	—
Old Corrugated Containers	1.00	"	—
Jute Corrugated Cuttings	1.07½	"	—

Bagging

(F. o. b. Boston)

Gunny Bagging—			
Foreign	(nominal)		
Domestic	4.25	@	4.50
Sisal Rope	4.75	"	5.00
Mixed Rope	1.25	"	1.40
Transmission Rope—			
Foreign	(nominal)		
Domestic	4.00	"	4.25
Manila Rope—			
Foreign	(nominal)		
Domestic	5.75	"	—
Soft Jute Rope	5.25	"	5.50
Jute Carpet Threads	3.25	"	3.50
Bleachery Burlap	8.50	"	9.00
Scrap Burlap—			
Foreign	(nominal)		
Domestic	4.50	"	—
Scrap Sisal	4.75	"	5.00
Scrap Sisal for Shredding	5.00	"	5.25
Wool Tares—			
Foreign	(nominal)		
Domestic	5.00	"	5.75
Aust. Wool Pouches	4.75	"	5.00
New Burlap Cuttings	5.25	"	5.50
Heavy Baling Bagging	4.75	"	5.00
Paper Mill Bagging	3.00	"	3.25
No. 2 Bagging	1.35	"	—*

*OPA Maximum Price.

Domestic Rags (New)

(F. o. b. Boston)

Shirt Cuttings—			
New Light Prints	.04½	@	.04¾
Fancy Percales	.04¼	"	.05
New White No. 1	.06½	"	.07
New Light Flannelettes	.06	"	.06¼
Canton Flannel, Bleached	.06½	"	.07
Underwear Cutters, Bleached	.06½	"	.06¾
Underwear Cutters, Unbleached	6.50	"	6.75
Silesias No. 1	.06	"	.06¼
New Black Silesias	.03¾	"	.04
Red Cotton Cuttings	.03¾	"	04
Soft Unbleached	.07	"	.07¼
Blue Cheviots	.06	"	—
Fancy	.02¾	"	—
Washable	.02¾	"	—
Khaki Cuttings	.03¾	"	.04
O. D. Khaki	.04½	"	.04¾
Corduroy	.03¾	"	.03¾
New Canvas	.07	"	.07¼
B. V. D. Cuttings	.07¾	"	.08

Domestic Rags (Old)

(F. o. b. Boston)

White No. 1—Repacked	3.80	@	—*
White No. 1—Miscellaneous	3.20	"	—*
White No. 2—Miscellaneous	2.65	"	—*
Twos and Blues, Repacked	2.20	"	—*
Old Blue Overalls	2.25	"	2.50
Thirds and Blues, Repacked	2.20	"	—*
Miscellaneous	1.80	"	—*
Black Stockings	3.50	"	4.00
Roofing Stock—			
No. 1	1.55	"	—*
No. 2	1.45	"	—*
No. 3	1.35	"	—*
No. 4	1.35	"	—*
No. 5, Quality A	1.35	"	—*
Quality B	1.20	"	—*
Quality C	.95	"	—*
Old Manila Rope	5.75	"	—

*OPA Maximum Prices.

Foreign Rags

(F. o. b. Boston)

Canvas	(nominal)
Dark Cottons	(nominal)
Dutch Blues	(nominal)
New Checks and Blues	(nominal)
Old Fustians	(nominal)
Old Linsey Garments	(nominal)
New Silesias	(nominal)

CHICAGO

Waste Paper

(F. o. b. Chicago)

OPA Maximum Prices.

Shavings—			
No. 1 Hard White Envelope Cuts, one cut	3.37½	"	—
No. 1 Hard White Shavings, unruled	2.50	"	—
No. 1 Soft White Shavings	2.50	"	—
No. 1 White Ledger	2.17½	"	—
No. 1 Heavy Books & Magazines	1.57	"	—
White Blank News	1.65	"	—
Mixed Kraft Env. & Bag Cuttings	2.75	"	—
No. 1 Assorted Old Kraft	1.75	"	—
Overissue News	.85	"	—
No. 1 News	.75	"	—
No. 1 Mixed Paper	.70	"	—
No. 1 Roofing Rags	1.55	"	—
No. 2 Roofing Rags	1.45	"	—
Soft White Shavings, Misc.	2.15	"	—
No. 1 White Ledger	2.17½	"	—
No. 2 Ledger, colored	1.87½	"	—
No. 1 Heavy Books & Magazines	1.57	"	—
Overissue Magazines	1.67½	"	—
New Manila Envelope Cuttings	2.65	"	—
No. 1 Assorted Old Kraft	1.75	"	—
No. 1 Mixed Paper	.70	"	—
Box Board Cuttings	.72½	"	—
Jute Corrugated Cuttings	.90	"	—
Overissue News	.85	"	—
No. 1 News	1.00	"	—